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Gender-specific drivers of best practice adoption among teff farmers in Ethiopia

Final Report

October 2022

The Impacting Gender and Nutrition through Innovative Technical Exchange in Agriculture (IGNITE) mechanism is a five-year investment to strengthen African institutions' ability to integrate nutrition and gender into their way of doing business and their agriculture interventions. IGNITE works with African agricultural institutions in Ethiopia, Nigeria, Burkina Faso, and Tanzania.

Photo: Woman in Lebe village, Amhara, Ethiopia. Radim Z (2015). Available at Wikimedia Commons.

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Acknowledgements

This study was conducted for Sasakawa Africa Association (SAA) as part of the decision-focused research arm of the IGNITE (Impacting Gender and Nutrition through Innovative Technical Exchange in Agriculture) project.

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This study benefited greatly from the gender expertise on IGNITE from Tanager and ACDI/VOCA, who provided numerous reviews and input to the research questions, design, and final report. These thematic experts include Benson Mutuku (Gender Expert, Tanager / IGNITE), Catherine Macharia-Mutie (Deputy Team Leader, Tanager / IGNITE), Sam Oando (Research Manager, Tanager / IGNITE), Mary Kate Cartmill (Tanager / IGNITE), Maureen Munjua (Team Leader, Tanager / IGNITE), Sarah Sahlaney (Senior Director, Gender & Social Inclusion, Tanager / IGNITE), and Jenn Williamson (Vice President, Gender and Social Inclusion, ACDI/VOCA).

IGNITE would also like to thank Sasakawa Africa Association (SAA) for their ongoing support and facilitation throughout the study, specifically Mel Oluoch, Ethiopia Tadesse, Melese Liyhe, Antoine Aoga, Fentahun Mengistu, and Getachew Minas.

Summary of Main Findings

The intrahousehold decision-making process on whether to adopt best practices (BPs) for teff farming in Ethiopia is complex, often involving input from women and men, who weigh numerous factors to arrive at a decision. These decisions are influenced by internal and external factors which drive the adoption of practices, and many of these drivers are gender-specific. Sociocultural norms mediate the roles that women and men play in teff farming and are a catalyst for many of the drivers of adoption (or non-adoption) identified in this study. By understanding these gender-specific drivers, SAA hopes to influence this decision-making process to increase adoption of best practices and make its training program for development agents (DAs) more gender-sensitive.

Gender-specific drivers of BP adoption

There are numerous drivers of BP adoption. Some are general in nature, and apply to all BPs, and some are BP-specific – focusing on just one phase of the teff growing cycle:

- **More access to information** – is strongly associated with more adoption of BPs, for both women and men. This finding is consistent with existing literature, which frequently finds low access to information is a barrier for adoption, especially for women.
- **More attendance to training** – is associated with more BP adoption for women when the training focuses on activities where women play a bigger role (e.g., weeding, sowing in rows). We also find that access to information (a driver of BP adoption) is strongly associated with attendance to training sessions for both women and men – an important finding for SAA's influence on BP adoption through training.
- **More control over income or teff output (whether to consume or sell)** – is strongly associated with more adoption of BPs when men are in control, and less adoption of BPs when women are in control. This finding suggests that more empowered women may be prioritizing other factors (e.g., time use) rather than the recommended practices.
- **More decision-making power on teff farming** – is generally associated with more BP adoption when men make decisions. For women, findings are mixed, and focused on BPs where women play a primary role (e.g., weeding, sowing in rows).
- **Having a female DA** – is significantly associated with more BP adoption for sowing in rows and weeding for women, suggesting gender norms could be influencing the effectiveness of training for women and men, depending on who is leading the training.
- **More membership to community groups** – is significantly associated with adoption for some BPs (harvest timing) for both women and men, and sowing in rows for men. This is likely explained by increased social interactions with the community. However, group membership is also associated with less adoption of weeding BPs for women.
- **More household members and wealth** – is associated with more BP adoption in general, a finding consistent with the literature. For household members, this is likely due to more access to labor, which is necessary for adopting time consuming best practices like sowing in rows and weeding by hand – practices where women play a leading role.

Mediating role of sociocultural norms

Women and men have distinct gender roles in teff farming which have a direct influence on whether or not women and men decide to adopt a BP. Women are involved at every stage of the teff farming process, but often to lesser degrees than men, and often performing different activities than men. They are less involved in plowing, herbicide and fertilizer application, and pest management, and more involved in weeding, harvesting and teff storage. They also have additional responsibilities outside teff farming, which involve childcare, food preparation, or tending to cattle and poultry.

Women are significantly less likely to view themselves as farmers and have less confidence in their abilities as farmers. There is a common conception in Ethiopia that women's roles take place indoors within the domestic sphere, and men's roles take place outdoors. Women are significantly less likely to attend training because of this view. On the other hand, some social norms dictate that women should be involved in important decisions and consensus within households should be prioritized, particularly around income from selling teff, livestock, or any other assets.

Decision-making process for BP adoption

Decisions on the adoption of best practices are complex, and the final decision is either made solely by men, or jointly with women. It is uncommon for women to make a decision on best practice adoption solely. Joint decisions are most common on weeding, post-harvest management, and selling teff. The process of planning to adopt, partially adopting, and fully adopting a BP often involves teamwork and the weighing of dozens of factors. Each best practice has a different decision-making process behind it, with women more involved in some decisions (e.g., weeding) and less involved in others (e.g., land preparation).

Decisions over how teff income is spent are primarily controlled by men, as they are the ones selling large quantities of teff following harvesting. Women have some control over income from small quantities of teff, as well as from other crops. Respondents report an understanding that this income will be used for inputs for the next year, or other household purchases, and that a husband should not use the income just for himself.

SAA's influence on decision-making

For both women and men, training attendance is strongly associated with increased knowledge of best practices, increased access to information, and more inputs into decisions on teff farming. By attending trainings with the DA, farmers are increasing their access to information and knowledge of BPs, which are key drivers of best practice adoption for women and men.

However, women are far less likely to attend training. The barriers to training attendance are strong for women, including sociocultural barriers, lack of time, and the gendered division of labor within the household that prevents them from attending training.

Recommendations

1. **Initiate activities that increase women's attendance to training.**
    - Women are much less likely to attend training than men, and training is a source of information and knowledge. SAA could take steps to increase women's attendance, including through women-only groups, a specific focus of female DAs, and more gender-sensitive training content.

2. **Address gender misconceptions and gender barriers.**

- There are common perceptions that women are not farmers and not capable of the same roles as men. These ideas are hindering women's ability to participate and gain knowledge. SAA could conduct Social Behavior Change Communication (SBCC) trainings with DAs to encourage a shift in perceptions.

3. **Increase access to quality information by addressing BP-specific misconceptions.**
    - Women have less access to information than men, and farmers have numerous misconceptions about specific BPs, especially those commonly led by women. SAA should directly address these misconceptions in a gender-sensitive way to increase the quality of information that farmers receive.

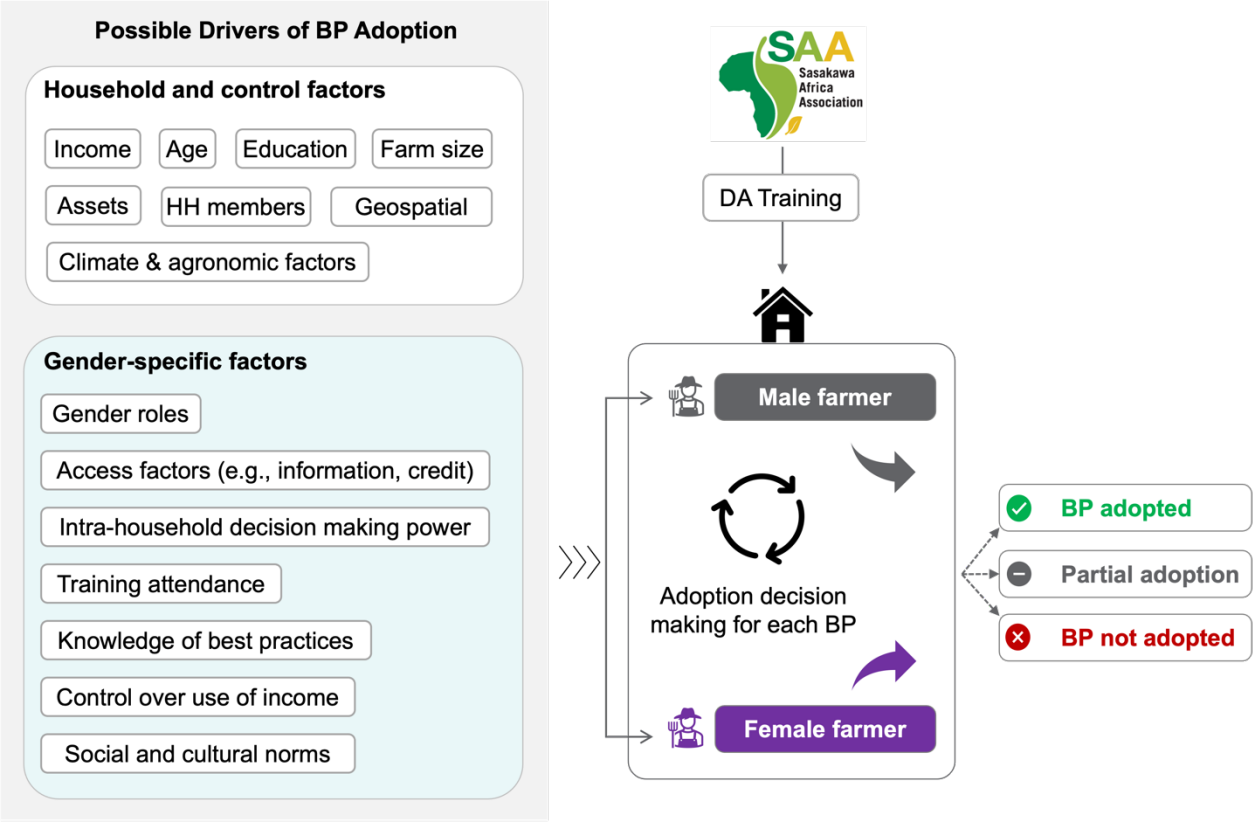
Introduction

This study identifies key gender factors that influence decision-making on the adoption of best practices (BPs) in teff farming households in Amhara, Ethiopia. It explores the intra-household decision-making process between women and men to adopt BPs and evaluates the level of BP adoption among sample households. The study focused on teff farming households living in Gonji Kollela and Yielmana Densa woredas in the West Gojjam zone of Amhara regional state. The study was conducted for Sasakawa Africa Association (SAA) as part of the decision-focused research arm of the IGNITE (Impacting Gender and Nutrition through Innovative Technical Exchange in Agriculture) project.

Conceptual Framework

This study is rooted in existing literature on drivers of BP adoption and decision-making theory and is unique in that it focuses primarily on understanding how gender-specific factors influence decision-making on the adoption of BPs. **Figure 1** illustrates a conceptual framework for the study. Each adult in teff farming households in Ethiopia is impacted by the factors differently, which influences the individual's participation in the decision to adopt, partially adopt, or not adopt the BP. The aim of this study is to gain insights into what is driving the decision to adopt the BP among SAA-supported teff-farming households in Ethiopia. As such, our primary outcomes of interest are these driving factors, including gender-specific factors (e.g., intra-household decision making, access factors) and traditional driving factors (labeled as household and control factors in the conceptual framework).

Figure 1: Conceptual framework for the study



Many of the household and control factors (e.g., farm size, household members, income) have already been shown to have an impact on best practice adoption in the literature[1], and this study confirms some of these findings. However, the association between the gender-specific factors and best practice adoption is considerably less researched. This study focuses on gender-specific factors and assesses if any of them are associated with more or less best practice adoption at the household level. Some of these gender-specific factors (e.g., decision-making, access factors, control over use of income) were identified as being important components of women's empowerment, as defined by the Women's Empowerment in Agriculture Index (WEAI)[2]. Other factors (e.g., training attendance, knowledge) were identified in the literature as being possible drivers of best practice adoption where we anticipated a gender differential in our sample. The gender-specific factors we explored were:

1. Gender roles of women and men in teff farming (community normative)
2. Access factors (information, savings, credit, social groups)
3. Control over use of income
4. Intra-household decision-making
5. Training attendance
6. Knowledge of best practices
7. Social and cultural norms

Research Questions

Primary Research Question

1. What gender-specific factors (e.g., decision-making power, access and control over inputs and information) drive the adoption of BPs in teff farming households in Ethiopia?

Secondary Research Questions

2. How do teff farming households in Ethiopia decide to adopt, plan to adopt, and finally adopt (or partially adopt) various BPs? How does this differ for households with different characteristics (e.g., socio-economic factors, access factors, intra-household factors)?

3. How has SAA's extension intervention influenced teff farming households' decision-making on the adoption of BPs?

Methodology

Quantitative data collection consisted of three rounds of a quantitative household survey with a final sample of 555 households, where one adult man and one adult woman from each household were interviewed in each round. An observation of one teff farming plot was also conducted at each household at each time period to evaluate the adoption of BPs. Round 1 (R1) was conducted during land preparation and sowing in August 2021, Round 2 (R2) was conducted during weeding and fertilizer application in October 2021, and Round 3 (R3) was conducted during harvesting, threshing, and storage in February 2022.

Qualitative data collection consisted of focus group discussions (FGDs) with farmers, in-depth interviews (IDIs) with farmers, and key informant interviews (KIIs) with development agents (DAs) and teff crop experts. In total, 9 FGDs, 12 IDIs, and 4 KIIs were conducted.

[1] Arslan, A., Floress, K. Lamanna, C., Lipper, L., Asfaw, S., & Rosenstock, T. (2020). The adoption of improved agricultural technologies: A meta-analysis for Africa. IFAD.

[2] IFPRI WEAI: https://weai.ifpri.info/about-weai/

Sampling. The sampling frame for this study includes all dual-adult teff-growing households within the SAA program in the study locations. To be eligible for the study the household must own at least one plot where teff is grown and should include at least one adult male and one adult female. The sample was stratified by kebele, and then a three-stage cluster random sampling method was employed. The primary sampling unit being the development agent (DA), the secondary sampling unit being the community demonstration plot (CDP), and the tertiary sampling unit being households. Within the household, two people were interviewed: one adult man and one adult woman.

Data & Analysis

Three methods of analysis were employed to answer the research questions:

1) Descriptive statistics
2) Econometric analysis using regressions to identify associations between variables
3) Qualitative analysis using word-for-word transcripts and thematic coding

Table 1 summarizes how these methods were used to answer the three research questions.

Table 1: Analysis methods used for each research questions

Research Question	Analysis Method Description
RQ1: Drivers of BP Adoption	• Descriptive statistics were calculated for the adoption rates of the 20 teff farming best practices observed, based on data collected from observation of teff plots in R1, R2, and R3. • The drivers of best practice adoption were primarily explored through quantitative econometric analysis, which employed regressions to determine associations between gender-specific and control factors and adoption outcomes. • These were complemented by relevant qualitative findings to provide additional context.
RQ2: Decision-making on BP Adoption	• Descriptive statistics were calculated for the adoption rates of the 20 teff farming best practices observed, based on data collected from observation of teff plots. • Qualitative data from FGDs and interviews focused on decision-making, and complemented the quantitative data collected in R1, R2, and R3
RQ3: SAA's influence on BP Adoption	• Econometric analysis was conducted using the gender-specific variables within SAA's sphere of influence (i.e., training attendance and knowledge of best practices) • Supplemented by the qualitative findings on DAs and perceptions of training

Report Structure

The report begins with a short review of the literature on the drivers best practice adoption, gender constraints to adoption, and decision-making in the household. We then provide information on the socioeconomic status of households in our sample as well as the community normative gender roles for teff farming. Following this, the report is structured by the three research questions – RQ1, RQ2, RQ3. We present the relevant findings for each and conclude with recommendations for SAA.

We also include a comprehensive appendix, which includes details on the best practices, agronomic findings, and any findings that might be of interest to SAA but are not directly relevant to the research questions.

Literature Review

In this section we provide a brief review of relevant literature to set context for the study. The Appendix provides further relevant literature including on teff in Ethiopia and farming best practices.

Drivers of BP Adoption

The question of what drives sub-Saharan African farmers to decide to adopt a BP or new technology has been researched for decades, and hundreds of factors have been explored as possible factors. In a meta-analysis of 168 published studies on the topic, IFAD identified 384 distinct determinants which they grouped into 43 categories.[3] It must be noted that many of these studies are gender blind, and consider the household as a single unit, collecting data from the male household head.

The five most common categories of drivers of adoption in this meta-analysis were:

1. **Socio-demographics** (e.g., age, education, gender of household head, household size)
2. **Resource endowments** (e.g., assets, farm size, income, wealth index)
3. **Biophysical factors** (e.g., land degradation, pests, diseases, plot fertility and slope)
4. **Information** (e.g., access to extension, access to information on BP)
5. **Groups / social capital** (e.g., group participation, access to government support)

Within each category, variables can be associated with positive, negative, or mixed adoption outcomes. These effects can also differ given the BP being researched. Therefore, it is difficult to generalize which factors are most important for adoption. Nevertheless, some factors consistently stand out in the literature as being positive, negative, or mixed in terms of association with adoption of BPs.

Factors that are commonly <u>positively</u> associated with BP adoption:

- *Higher income*, both on-farm and off-farm, as income allows for investment[4]
- *More education*, increases ability to obtain, process, and use information[5]
- *Larger farm size*, as these farms have more space and income to try new technologies and practices[6,7]
- *More household members*, as there is more available labor[8]
- *Access to information*, which is required to learn about a technology or practice[9]
- *Access to extension*, which is a common method of learning about BPs[10]
- *Access to credit*, as often adoption requires additional investment[11]
- *Ownership of livestock,* which is a source of income and can be used for plowing[12,13]

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[3] Arslan, A., Floress, K. Lamanna, C., Lipper, L., Asfaw, S., & Rosenstock, T. (2020). The adoption of improved agricultural technologies: A meta-analysis for Africa. IFAD.

[4] Diiro, G. (2012). Impact of off-farm Income on agricultural technology adoption intensity and productivity. https://www.ifpri.org/publication/impact-farm-income-agricultural-technology-adoption-intensity-and-productivity

[5] Feyisa, B. (2020). Determinants of agricultural technology adoption in Ethiopia: A meta-analysis, Cogent Food & Agriculture, 6:1, DOI: https://doi.org/10.1080/23311932.2020.1855817

[6] Gabre-Madhin, Z. and Haggblade, S. (2001). Success in African Agriculture: Results of an Expert Survey. IFPRI. Washington, DC.

[7] Feyisa. (2020).

[8] Mignouna, B., Manyong, M., Rusike, J., Mutabazi, S., & Senkondo, M. (2011). Determinants of Adopting Imazapyr-Resistant Maize Technology and its Impact on Household Income in Western Kenya: AgBioforum, 14(3), 158-163. http://hdl.handle.net/10355/12461

[9] Kariuki et al., 2015.

[10] Feyisa. (2020).

[11] Feyisa. (2020).

[12] Feyisa. (2020).

[13] Hasen, M. (2015). Adoption of multiple agricultural technologies in maize production of the Central Rift Valley of Ethiopia. Studies in Agricultural Economics, 117(3), 162–168. https://doi.org/10.7896/j.1521

- *Belonging to social groups*, as it enhances idea and information sharing[14]
- *BP-specific factors,* like the trialability of the practice or technology, as well as positive farmer perceptions of the technology, and low cost required to adopt [15,16,17]

Factors that are commonly negatively associated with BP adoption:

Negative associations are simply the inverse of the positive associations above (e.g., low income, less education).

Factors that have mixed effects on BP adoption:

- *Age*, as older farmers tend to be more risk averse, but are also more experienced[18]
- *Spatial factors*, including elevation, and distance to markets, roads, and transport[19]
- *Climate factors*, including rainfall, temperature, and soil quality
- *Sociocultural factors*, which vary widely across countries
- *Personal traits of farmers*, including confidence, risk tolerance, self-efficacy[20]
- *Gender*, as discussed in the following section

Gender and Adoption of Best Practices

Evidence across sub-Saharan Africa shows that MHHs adopt new agricultural technologies at a faster rate than female-headed households (FHHs).[21,22] However, many studies do not find the gender of the household head to be the primary driver, rather, a variety of socio-economic and access factors (e.g., education, access to inputs and extension, size of plot) where women are often disadvantaged in comparison to men.[23] These results suggest that the differences between FHH and MHH in accessibility of inputs and resources constitute a major barrier for many women farmers.[24] Nevertheless, there is ongoing debate on which of these drivers is most significant, and whether women and men fundamentally differ in their adoption decisions in addition to their differing access to and control of inputs and resources.

The question of how to measure gender differentials in the adoption of BPs has received considerable attention in recent years. Women and men farmers are heterogeneous groups of individuals,[25] yet many studies have chosen to focus on comparing FHHs to MHHs, which simplifies the research process, but ignores the vast majority of women who live and work within

[14] Feyisa, 2020.

[15] Kariuki et al., 2015.

[16] Doss, C.R. (2003). Understanding Farm Level Technology Adoption: Lessons Learned from CIMMYT's Micro- surveys in Eastern Africa. CIMMYT Economics Working Paper 03-07. Mexico, D.F.: CIMMYT.

[17] Mignouna et al., 2011.

[18] Kariuki et al., 2015.

[19] Feyisa, 2020.

[20] According to Albert Bandura, who first defined the term, self-efficacy is "the belief in one's capabilities to organize and execute the courses of action required to manage prospective situations."

[21] Doss, 1999.

[22] Tiruneh, A., T. Tesfaye, W. Mwangi, and H. Verkuijl. 2001. Gender differentials in agricultural production and decision-making among smallholders in Ada, Lume and Gimbichu Woredas of the central highlands of Ethiopia. Centro Internacional de Mejoramiento de Maiz y Trigo, Ethiopian Agricultural Research Organization, and the European Union, Mexico City. https://repository.cimmyt.org/handle/10883/1018

[23] Ragasa, 2012.

[24] Peterman, A., J. Behrman, and A. Quisumbing. 2010. "A review of empirical evidence on gender differences in non-land agricultural inputs, technology, and services in developing countries," Washington, D.C. IFPRI. http://www.fao.org/3/am316e/am316e.pdf

[25] Ragasa, C. 2012. Gender and Institutional Dimensions of Agricultural Technology Adoption: A Review of Literature and Synthesis of 35 Case Studies", for IAAE Conference. August 18-24, 2012, Foz do Iguaçu, Brazil. https://ageconsearch.umn.edu/record/126747/

male-headed households.[26] Furthermore, the definition of a female- or male-headed household is often inconsistent or unclear, which further complicates the measurement and comparison across studies.[27] Therefore, there is a need for research that focuses on women and men in farm households, including the women living in male-headed households, as this study does.

Adoption Constraints for Women

Across sub-Saharan Africa, women often face additional constraints compared to men when it comes to deciding to adopt a technology or BP. In a literature review of 35 studies, Ragasa[28] grouped these constraints into categories:

1. Limited access to information or low literacy rate to use the information

Weaknesses in education and extension systems means millions of women and men lack the literacy, training, and skills needed to increase their agricultural productivity. Women farmers generally have lower education levels, which affect their understanding and adoption of BPs especially if the technology requires use of more technical and intensive knowledge.[29] This issue is exacerbated in rural areas, where poor rural women tend to be underserved by both the education and extension systems. Rural women in many parts of Ethiopia are less literate[30] and attend fewer extension trainings than men, meaning women's access to information is lower than their male counterparts.[31] Furthermore, lack of intra-spouse communication is a common barrier to information access, as it is common for only one household member to be trained in extension programs. As a result, information on BPs does not always cascade to all household members (often women) who are dependent on their spouse to receive information.[32]

2. Limited access and control over inputs, income, labor, and services

Simply being aware of a BP or technology is not enough to ensure that the technology is adopted. Numerous inputs are required to adopt a BP, including access and control over income and credit, access and control over labor and land, access to ICT, and many others. Across sub-Saharan Africa, women are often disadvantaged in their access and control over these inputs and services, and many studies have identified this as a leading constraint to adoption.[33,34] Furthermore, women often face an increased time burden for household duties (e.g., childcare, meal preparation, fetching water) and reduced access to other labor sources. Women often do not have the additional labor of men to support their plots as men will often concentrate their own labor on the plots they manage. Women's traditional agricultural duties can also be concentrated in more time-consuming activities (e.g., weeding), which limits the amount of time available for more enjoyable or leisure activities.

3. Availability, affordability, and usability of technologies

Some BPs (e.g., weeding, planting in rows) do not require any additional purchase of technology to adopt, but often require additional labor. Other BPs (e.g., improved seeds, fertilizers,

[26] Doss, C.R. 1999. "Twenty-five years of research on women farmers in Africa: Lessons and implications for agricultural research institutions; with an annotated bibliography." CIMMYT Economics Program Paper 00-02. Mexico, D.F.: Centro Internacional de Mejoramiento de Maíz y Trigo (CIMMYT).

[27] Ragasa, 2012.

[28] Ragasa, 2012.

[29] Ragasa, 2012.

[30] Wright, A. (2020). Closing the Gender Gap: Women's Rights in Ethiopia and Mexico. Global Majority E-Journal. 11(1). pg. 47-60.

[31] World Bank and IFPRI. 2010. Gender and governance in rural services: Insights from India, Ghana, and Ethiopia. Washington, DC: IFPRI and World Bank.

[32] O'Brien, C., Gunaratna, N.S., Gebreselassie, K., Gitonga, Z. M., Tsegaye, M., & De Groote, H. (2016). Gender as a Cross-Cutting Issue in Food Security: The NuME Project and Quality Protein Maize in Ethiopia. https://onlinelibrary.wiley.com/doi/abs/10.1002/wmh3.198

[33] Ragasa, 2012.

[34] World Bank and IFPRI, 2010.

mechanization) require a household to rent, borrow, or purchase a technology. To adopt these technologies, they need to be both available and affordable for farmers. Availability is a function of numerous factors including effectiveness of distribution systems, geographic location, and remoteness, among others. Affordability is a function of the profitability of adopting the technology combined with liquidity constraints and access to credit for farmers. Women farmers are often disadvantaged with respect to both factors.[35] In addition, the question of usability of a technology must also be considered. Certain technologies (e.g., heavy machinery for ploughing) can be physically demanding or require training to operate, which can further disadvantage women.

4. Sociocultural constraints

Customs, religious beliefs, social norms, and traditions vary dramatically across countries and regions and play a significant role in determining men's and women's roles in the agricultural sector, as well as what information, technologies, or inputs women and men can access. In many cases, cultural beliefs place increased burdens on women's adoption of BPs. Depending on the country, these burdens include limited access and control over income, limited access to social groups, limited access to transport services, and countless others.

In Ethiopia these factors play a dominant role. For example, Ethiopian cultural norms prevent women from plowing fields. This disadvantages women without adolescent or adult sons, who must hire additional labor to plow the fields or break with tradition.[36] Another example is that there is a cultural perception in Ethiopia that men are the decision-makers in the household, so extension agents commonly choose to work with men.[37]

5. Gender gaps in rural institutions

Farmer organizations like cooperatives, self-help groups, and community-based organizations have been shown to facilitate collective action, increase the bargaining power of poor farmers, and can lead to increased adoption of BPs.[38,39] Women's participation in these groups has also been shown to increase group effectiveness in many cases.[40] Despite these benefits, women are often underrepresented in both membership and leadership of these groups.[41] Women's lack of access to transport, social and cultural norms, and greater time burdens in the household all contribute to their under-representation in farmer organizations.[42]

6. Gender gaps in extension systems

Women continue to be underrepresented as extension agents and field workers, despite numerous studies finding that women farmers prefer to be served by women extension agents and that there are numerous benefits from a production perspective.[43] Second, men are often the first farmers called to extension training, and there is an unfounded expectation that the information taught to the man will cascade to the other members of the household.[44] Third, the perception that "women are not farmers" persists across many regions of Africa, including

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[35] Ragasa, 2012.

[36] Pender, J., and B. Gebremedhin. 2006. "Land management, crop production and household income in the highlands of Tigray, northern Ethiopia: An econometric analysis." Washington, D.C.: International Food Policy Research Institute.

[37] World Bank and IFPRI, 2010.

[38] Peterman et al, 2010.

[39] Uphoff, N., and L. Buck. 2006. "Strengthening Rural Local Institutional Capacities for Sustainable Livelihoods and Equitable Development." Paper prepared for the Social Development Department, World Bank, Washington, DC. https://openknowledge.worldbank.org/handle/10986/8194

[40] Ragasa, 2012.

[41] World Bank and IFPRI, 2010.

[42] Ragasa, 2012.

[43] World Bank and IFPRI, 2010.

[44] Ragasa, 2012.

Ethiopia.[45] These barriers in extension provision disadvantage women and constrain their ability to adopt BPs.

Decision-making in the household

The process of decision-making in farm households in sub-Saharan Africa is complex and varies widely across and within countries. There is also ongoing debate about whether joint decision-making or sole decision-making is preferable in terms of outcomes, and under what circumstances.[46] For example, in the Women's Empowerment in Agriculture Index (WEAI), empowerment is assessed on whether a respondent has any form of decision-making power (sole or joint) but does not value one higher than the other.[47]

Despite these challenges, some consistent findings have emerged in the literature with respect to household decision-making in Ethiopia. Aregu *et al*.[48] conducted a gender analysis in 10 woredas which found that decisions on technology adoption are mainly taken by men, with some making joint decisions. However, it was noted that husbands often consulted their wives in the process which had a strong influence on the outcome.[49] The same study found that decisions were predominantly male dominated in rich and middle-income households, and that joint decisions were more common in poor households. This may be because men in poor households more commonly engage in casual labor and temporary economic migration, which may lead to women having more power in these households due to the absence of men.[50] Poorer households also had less distinct gendered division of labor and shared income more equitably.[51] A similar finding is found by Gebre *et al*.[52] in the maize value chain in Southern Ethiopia. Only in female-headed households do women control decision-making on technology adoption, and even in those cases male relatives were often consulted.[53] All of these findings are further confirmed in a study by Yadeta and Abashula[54] in Yayu woreda, which found that the wife is almost never solely responsible for decisions.

These findings indicate that BP adoption decisions in Ethiopia are complex, and that each specific practice involves the husband and wife in varying degrees, with the husband typically playing a more dominant role, and women almost never making decisions autonomously.

[45] World Bank and IFPRI, 2010.

[46] Acosta, van Wessel, van Bommel, Ampaire, Twyman, Jassogne & Feindt. (2020).

[47] IFPRI. (2012). Women's empowerment in agriculture index. https://www.ifpri.org/publication/womens-empowerment-agriculture-index

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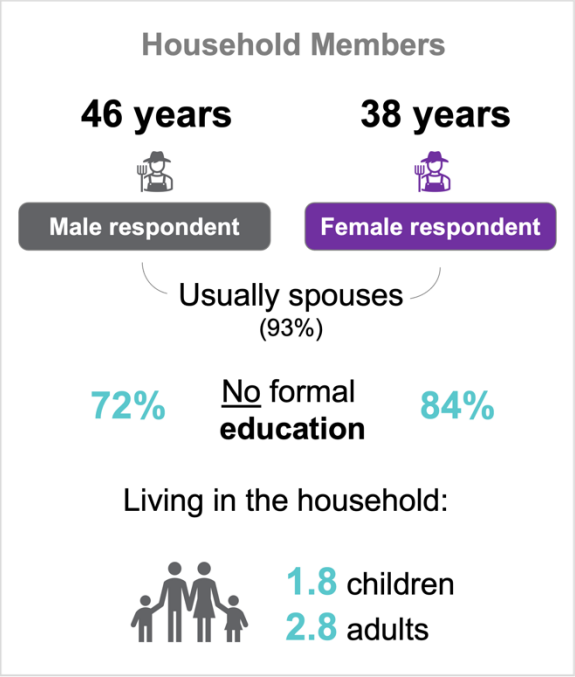
Context: Household & Community Characteristics

This section provides context for the study, and reports descriptive statistics on the characteristics and socioeconomic status of the 555 sampled households, with sex-disaggregated information reported where relevant. These variables were used as controls throughout our econometric analysis in this report. The section also includes a summary of the community normative gender roles in teff farming in the study area, which is crucial for understanding the drivers of best practice adoption.

In later sections of the report, many of these factors will be used as control factors in the econometric analysis, and some will be identified as drivers of best practice adoption.

Socioeconomics

Figure 2: Summary of household members



Households in our study population have on average 4.6 members: 2.8 adults and 1.8 children. The mean participant age is 42 years old — 46 years old for men, and 38 years old for women. In almost 93% of cases, the two respondents are spouses, while 4% are the son or daughter of the respondent. The remaining 3% are either grandparents, cousins, or parents of the respondent.[55]

Women farmers are more likely to report having no, or only informal, education. Most farmers (78%) have no formal education (defined as having completed primary school or above). The share of women farmers with no formal education is higher (84%) than that of male farmers (72%), a difference that is highly statistically significant. At the household level, 60% of households have no formally educated members, while over 20% of households have only one formally educated respondent.

Living Conditions

According to the Multidimensional Poverty Index (MPI)[56] the majority of households in our sample are considered deprived on multiple dimensions:

- **Housing** — Dung covers the floor in 84% of households in the sample, while 15% are covered in sand or earth. 99.1% are considered deprived.
- **Cooking** — Households in our sample typically use rudimentary wood planks for cooking (81%), followed by animal dung (11%). 99.8% are considered deprived.
- **Sanitation** — 38% have no toilet facilities and practice open defecation. Approximately 40% have access to a pit latrine with slab, and 23% to open pit latrines. 23% of sampled households share their toilet facilities with others. 99.9% are considered deprived.

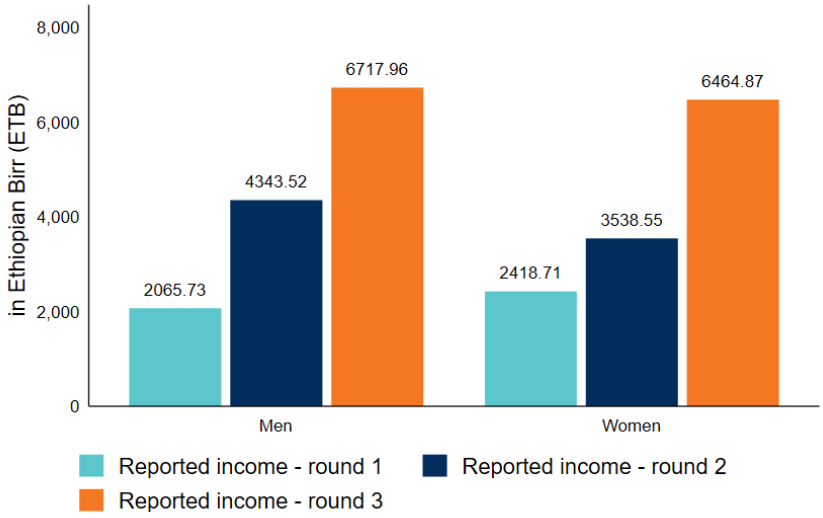
[55] Since not all respondent pairs are spouses, throughout this report we refer to each respondent as the male or female respondent.
[56] These dimensions make up the living standards component of the Multidimensional Poverty Index (MPI) published by UNDP's Human Development Report Office.

- **Water** — Households get their water from tube wells and boreholes (62%), public taps and standpipes (22%), or from surface water, such as rivers, streams or lakes (10%). Other sources include unprotected springs and wells. The mean time spent walking to the water source is 21 minutes. 19.9% are considered deprived.
- **Electricity** — 14% of households in our study population have access to electricity, meaning 86% of households are considered deprived.

Monthly Household Income

Throughout the three rounds of data collection, we observed significant fluctuations in household reported income. Respondents were asked to report how much their household earned in the past 30 days. The highest measured household income is reported by men and women at the end of the meher season.

Figure 3: Household Reported Income Differences - Average Reported Income



Households have more income following harvesting, while the lowest income is reported in the early season (the first data collection point). These findings are consistent with the literature on seasonal income fluctuations in agriculture. In round 1, women reported higher monthly household incomes than men, a difference that is statistically significant. In round 2, women's reported household income was significantly lower than the value reported by men. In round 3, there is no statistically significant difference in reported household income between men and women. As women and men were asked to provide estimates for household income, not individual income, it is not possible to disaggregate the analysis further. One possible cause of these discrepancies may be poor intra-household communication, whereby some respondents are not aware of recent income sources, such as asset or livestock sales. Another possible reason is ambiguity in the definition of income, and different perceptions by different individuals. Finally, there is also the possibility of enumerator effects. These intra-household reporting differences are common in other studies with multiple respondents per household.[57]

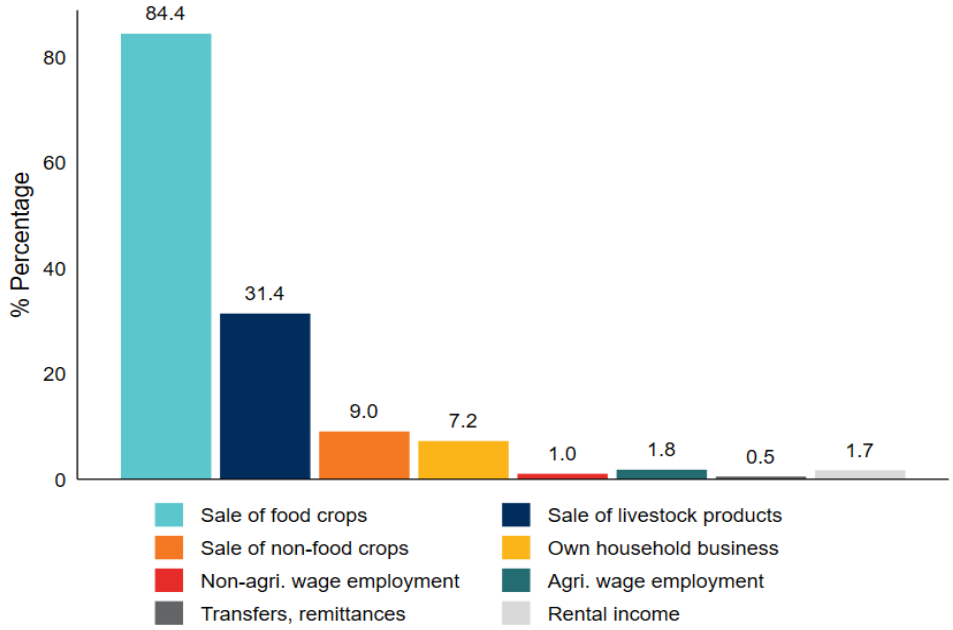
Income-Generating Activities

On average, households generated income from 1.7 economic activities (e.g., selling food crops and selling livestock products) in the past 12 months. Income is most frequently

[57] World Bank. https://blogs.worldbank.org/impactevaluations/does-it-matter-who-answers-survey-identify-families-poverty-guest-post-adan-silverio-murillo

generated from the sale of food crops, as well as the sale of livestock products (e.g., dairy, eggs), followed by the sale of non-food crops (e.g., cotton, tobacco).

Figure 4: Income-generating Activities, Average Values for the Meher Season



Household Assets

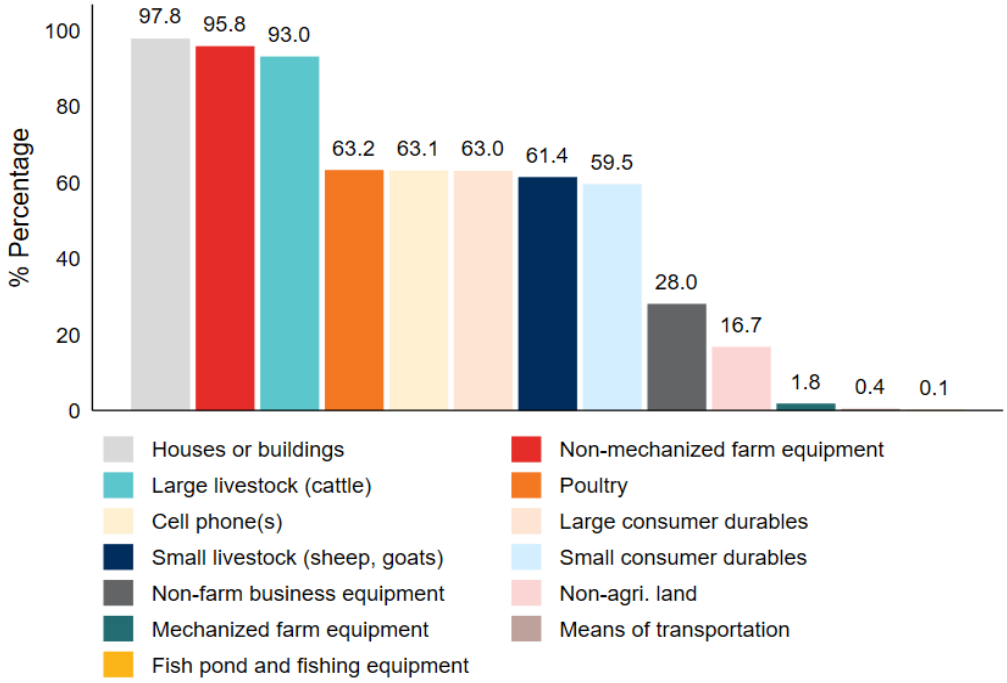
Houses,[58] non-mechanized farm equipment, and large livestock are some of the most common assets households own.[59] In our sample, 63% of households own poultry, 61% own small livestock (e.g., sheep, goats). 63% of households also own cell phones and large consumer durables,[60] while 60% own small consumer durables (e.g., radios, cookware). These percentages are based on the average responses of the male and female respondents in the household.

Small agricultural implements are common. Almost all households' own hoes, sickles, or axes, while 92% of households own pitchforks. For land preparation, 90% of households own a traditional plow (maresha), while 78% own shovels. Irrigation is typically done using watering cans, which are owned by 36% of households. Similarly, pesticides are usually applied using knapsack sprayers, owned by 46% of households.

Large agricultural assets are infrequent — 83% of households report not owning any. The most common large assets are modern plows[61], owned by 9% of households.

[58] This is most often the home the household lives in.
[59] This part of the survey required the male and female respondents to report asset ownership at the household level.
[60] In the WEAI, this category includes furniture like beds and tables, along with refrigerators or televisions. This question however does not allow differentiation at the household level. As seen by other measures (i.e., deprivation in the multidimensional poverty index, monthly income) households are relatively poor in our study population. While it is very common for poor households in this region to have a bed, very few (if any) have a refrigerator or a television.
[61] A traditional plow is usually made of wooden sticks tied together, with a metal point to cut the soil and two wooden wings next to the point to push the soil into a furrow. Generally, besides the metal point, the plow is homemade. A modern plow is one that is primarily metal and can be fixed to a manual or fuel-based machine. The entire modern plow is purchased (not homemade).

Figure 5: General Household Asset Ownership



Women and men have similar ownership rates (both sole and joint) for several asset categories, such as houses, large and small consumer durables, livestock, or business equipment. Cell phones are an exception, with women reporting significantly less sole ownership, and more likely to not own one at all.

Notions of individual and joint ownership were explored. Large assets, such as land or livestock, were seen as joint assets, belonging to the entire household. Insisting on individual ownership is uncommon and might endanger the stability of the family, as a woman farmer explained, “The land is ours. It is shared. The livestock is also a shared asset… If we say ‘it is mine! No, it is mine!’ Then the family will be broken. It will then lead to separation.” A male farmer agreed, “Nothing is an individual possession. There is no such thing.”

> *“Let alone the husband and wife, the children as well are the owner of the asset. Because it is from that asset I share for my children when they start their own family. This is common that all assets are owned by the whole household members. Legally it is for the husband and wife but in reality it is for the whole family including children.”*
>
> **— Male participant, mixed-gender FGD**

Under Ethiopian law, land deeds are registered in the name of both the husband and the wife. Many participants also stated that children too have a stake in land and livestock ownership, as they will be gifted pieces of land or cattle once they marry.

Smaller assets such as cellphones are usually seen as individual possessions, which can be used jointly by the man and the woman, but usually belong to, or are kept in the possession of, the man. However, some male respondents indicated that cellphones are a joint possession

as well, and all members of the household share usage rights over them. Despite some variation at the household level, the qualitative results indicate that there is a social norm of joint ownership of large assets at the household level, which also influences how individuals think about small assets.

> *"I have a mobile phone and we all use it. I may mostly have it at hand because the communication and external linkage is allotted for me, she has limited connection, otherwise it is used by all. Her relatives call her and talk to her as they want when I go back to my home. As a result I presume that the ownership is for both."*
>
> **— IDI with male farmer**
>
> *"The mobile phone is his. I don't know how to use it. He lets me talk to people when they call. That's all."*
>
> **— IDI with female farmer**
>
> *"The mobile phone…Nobody touches my phone. And I don't touch the family's phone. (This is a second mobile phone that the wife and her two daughters use at home. It is not considered to be owned by anyone in particular.) So, mobile phones, clothes and things like this are individual possessions."*
>
> **— Male farmer, IDI with couple**

Farm Characteristics

Households farm an average of 5.1 plots; 25% of which are rented. Total farm size (encompassing all plots) is on average 1.2 hectares. Households own the plot their house is on in 87% of cases.

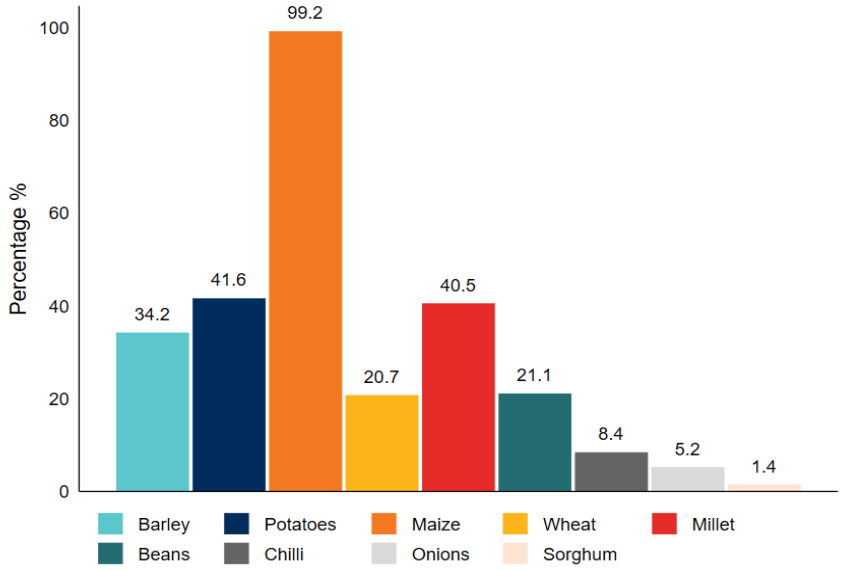
A reported 163 plots in the sample are managed by women (corresponding to 3% of the 5,592 total). In 87% of households, women work on teff plots, but only 4% of households have a woman plot manager supervising the day-to-day activities of a teff plot.

On average, farmers grow teff on 2.7 plots, amounting to about half of their plots. Plots are typically small and under 0.5 hectares in size – however, the largest plots can reach up to 1.3 hectares. Typically, the plot on which the house is located is used for other crops: only 15% of home plots have teff on them. On plots where teff is grown, teff covers on average 60% of the total plot area, while the rest is used for other crops.

All households in our sample grow teff, along with a variety of other crops, with 99% of households also growing maize. As detailed in Figure 6, potatoes (42%), millet (41%) and barley (34%), beans (21%), wheat (21%) are also commonly planted. Home plots managed by women have a higher share of legumes and vegetables (e.g., potatoes, beans, onions, and beetroot), owing perhaps to the fact that women are largely responsible for household food and nutrition decisions. Other plots managed by women are predominantly used for growing potatoes or cereals (e.g., maize, teff).

In our sample, 60% of the household income is derived from teff. Out of the total amount of teff they produce, households report keeping 36%, while the remaining 64% is sold for income or used as inputs in the following year.

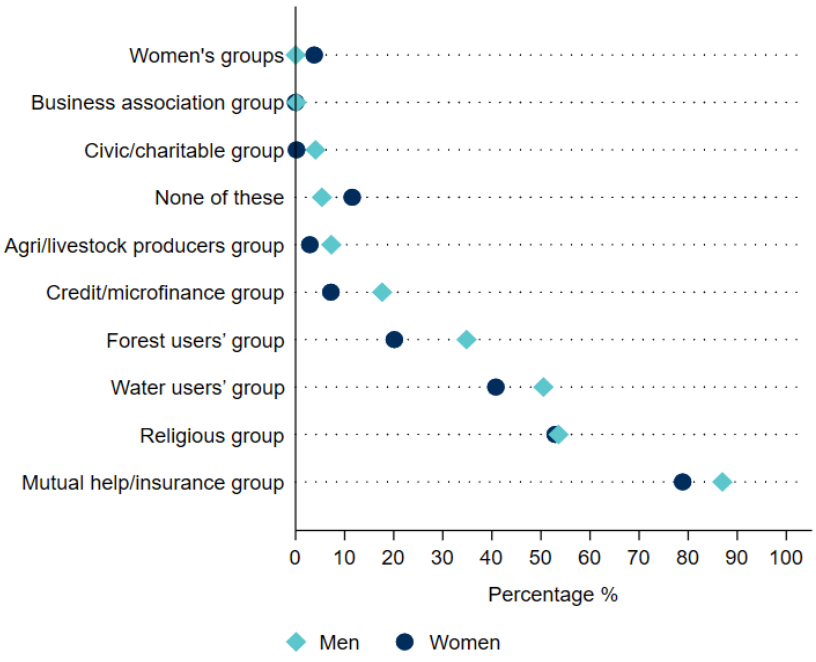
Figure 6: Share of Households Farming Crops Other Than Teff



Access to Social Groups

96% of men belong to a social group, compared to 76% of women. Farmers in our study belong to more than two groups on average, with men (2.5) belonging to slightly more than women (2.0). The most common groups for both men and women are mutual help and insurance groups (e.g., burial societies) registering 82% membership. About half (53%) of men and women in our study population also belong to religious groups. Men consistently have higher membership rates for all groups. There is a weakly statistically significant difference (p=0.07) between women (12%) and men (5%) reporting no group membership.

Figure 7: Group Membership, Disaggregated by Sex

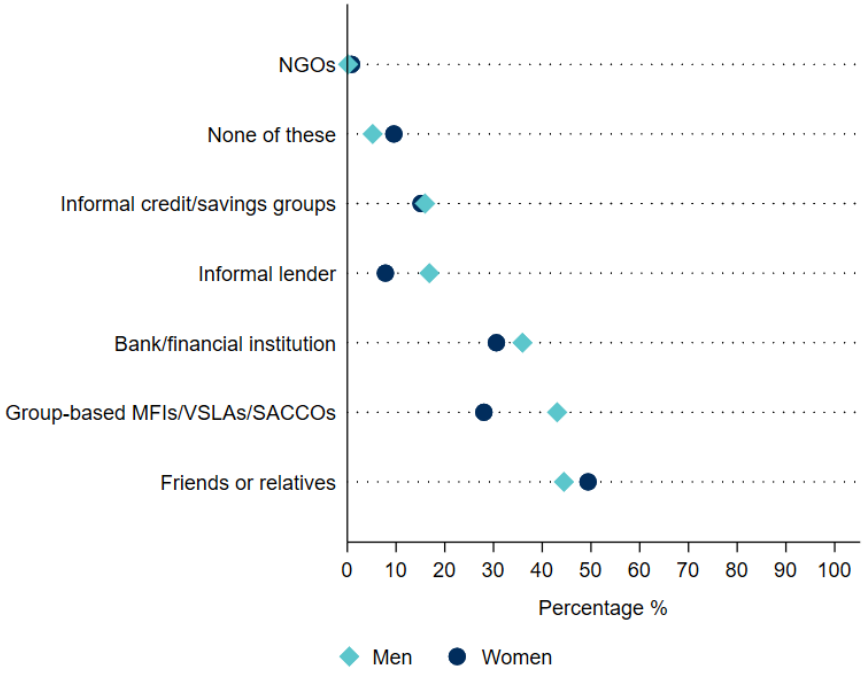


Access to Savings and Credit

More than half (55%) of men and one-fourth of women (25%) have an account with a bank or other formal institution (e.g., post office, mobile money, microfinance). Of these formal accounts, 19% of both men and women report having a joint account, while 80% (81% of men and 78% of women) have an individual account. This means that in some households, a male respondent is reporting a joint account, while the female respondent is reporting no account ownership. For the joint accounts, 90% of men and 92% of women report not being able to access the money in it independently without the other account owner present.

Almost all (93%) of our sampled population reports being able to access a credit from at least one source. Women are significantly more likely to have no access to any credit, from either formal or informal sources (10% of women as compared to 5% of men, p = 0.02). Men tend to rely on friends and relatives (44%), as well as formal institutions such as group-based microfinance (43%) and banks (36%). Women rely on friends and relatives (49%), banks and formal credit (30%), and group-based microfinance (28%). While it is not a large difference, friends and relatives is the only category where more women than men report having access to credit, highlighting that women not only have less access to credit, but their sources of credit could be more likely to be through social networks.

Figure 8: Reported Access to Credit, Disaggregated by Sex



Gender Roles

Men and women were asked about their roles in each phase of teff farming (from land preparation to selling) as well as in other household activities. This section provides a sex-disaggregated view on perceptions of these community normative roles according to both men and women. Understanding these roles provides important context for the drivers of best practice adoption analysis.

Involvement and Perceptions of Involvement

Teff farming is traditionally seen as a male-dominated activity. As observed in our sample, male respondents assume the plot manager role in 97% of plots analyzed, meaning that women-managed plots are rare. Our qualitative findings indicate that the man is perceived as the plot manager and more knowledgeable on teff farming in general; women are regarded as playing a supporting role in the farming process and assisting in some way at all stages of teff cultivation. As a female farmer explained, "The women spend most of their time at home by preparing food, while men are mainly responsible for managing and supervising farming activities, especially for the activities made outside. In general, the direction is given from men but the women also share and support the activities that they can."

> *"Usually activities in our teff plot are managed by mainly men including children. Men plan for different activities and the women provide support. In general we have our own stake in each stage. For example, plowing is for men, clearing the land is both for male and female. Weeding and harvesting is for both family members. Threshing is for male and children.*"
>
> **— IDI with male farmer**

The perception appears to be that women are more involved in the domestic sphere, with activities such as food preparation or childcare, and offer support to men when needed. One woman farmer noted, "I may or may not work in the field. But he…will the family even survive without him? No… I was only taught about a mother's job at home. I wasn't taught about a father's job…[about] farming." Some farmers report a desire to have men work outside the home and women work inside the home, with one male farmer saying, "She is a housewife and I am a farmer. It is not that a woman shouldn't help. It is just that I work hard enough and take care of it well." This also suggests that a traditional view of masculinity encourages men to provide and undertake farming activities alone (or lead them). As one DA noted, "They have different ways of thinking. This is how they have been living for so long…the men thinking housework is not their concern and women thinking work done outside the house is not their concern."

As teff farming is a labor-intensive process (and a large portion of family income), most women cannot afford to strictly stay home and not get involved in farming. One woman farmer reported, "About half of the women stay home. The other half work on the fields with their families. But even if I wanted to stay home, my husband wouldn't let me." In some cases, this results in a double workload for women, as they are responsible both for household chores and teff farming. One woman farmer noted, "We help with land preparation; we help with planting…we do everything together. I would say the women's workload is heavier. The man comes from the farm, washes up and sits down while the woman keeps on working at home too. She then has to get up earlier to cook before it's time for her and her family to go to the farm." Particularly during harvest time, women's workload tends to be particularly heavy, as noted by a woman farmer, " Those days are very challenging for the woman. She suffers. There is too much work to do."

Women plot managers are a rare sight, with some participants marveling at the idea. "What?! No! None!" was the reaction of one woman farmer when asked if she has seen women

who manage their teff plots. Another woman farmer agreed, noting, “We [women] are mainly concerned with the work and not much about managing the teff plots.” In the case of married couples, it is usually the husband who manages the plot, while in female-headed households, women can be plot managers. As a DA explained, “The plots are managed by the male or female head of the household… It is the husband who inspects the farm to see how the plants are. If there is any problem, he is the one who reports to experts.” However, there are exceptions, as noted by a woman farmer, “Not every man is the same. Not every woman is the same. There may be some women who don’t go out to check on their fields… Mostly, it is the men who manage the plots. But if the woman is strong, she goes out with her husband and helps with the work and manages the field with him.”

Women are perceived to be incapable of independently managing plots, requiring the support of men to manage more labor-intensive activities These men may be spouses, male family members in the household, or men outside the household, such as relatives, neighbors, or hired laborers. Women are perceived to be incapable of managing the entire teff growing cycle by themselves. As a male farmer explained, “women household leaders cannot manage all farming activities by themselves, rather they either get support from neighbors, hire labor, or depend on their sons. Here the effectiveness does not depend only on her, rather it depends on the second person who is responsible to manage the activities.” A woman farmer agreed but noted that men traditionally still hold more power with respect to managing teff farming, “Well, the man is the boss. Mostly, it is the man. However, even I manage things. I have worked on [the farm] too. So why wouldn’t I also manage it?” Another woman farmer also noted, “They [spouses] actually do many things together… like planting [and] weeding. But it is the man who takes the main responsibility.” These men and women highlight the dissonance between the amount of work women are doing on teff, and their perceived dependence on men.

Teff Farming Roles

Women and men were asked about their personal level of participation in each phase of the teff farming growing season, as well as their perceptions in their community of the roles for women and men.

Nearly all men and all women reported that they perceived men to be involved in each activity. That is, for all activities, between 92–100% of all respondents reported men being involved in their community, clearly suggesting that men are involved in all aspects of teff farming.

Women’s involvement in teff farming is reported to be equal to men for some activities, and significantly less than men in others. For example, 99% of both women and men reported that women are involved in weeding in their community. For other activities, like fertilizer application, women and men also generally agree on the level of involvement (~69% of both women and men report women being involved), but the level of involvement is less (~69% vs. 99%).

However, for three activities (land preparation, sowing, pest management) there is a disconnect between perceptions of involvement. For these activities, women’s perceptions of their own involvement is higher than men’s perceptions of women’s involvement. That is, women believe women to be more involved in sowing and land preparation than men believe them to be involved.

Table 2: Community perceptions of involvement of women and men in teff farming

	According to **Men**		According to **Women**	
	Men's involvement	Women's involvement	Men's involvement	Women's involvement
Land Preparation	**100%**	**80%**	**100%**	**87%** ↑
Sowing	**99%**	**49%**	**99%**	**69%** ↑
Fertilizer Application	**99%**	**68%**	**100%**	**69%**
Weeding	**100%**	**100%**	**100%**	**99%**
Pest Mgmt.	**96%**	**72%**	**92%**	**78%** ↑
Harvesting	**100%**	**99%**	**100%**	**99%**
Threshing	**100%**	**86%**	**100%**	**86%**
Post-Harvest Mgmt.	**100%**	**98%**	**99%**	**99%**

Land Preparation

99% of men farmers and 80% of women farmers report being personally involved in land preparation (clearing crop residue, comparing the soil, and plowing). Of these, 88% of men reported a very high or high level of involvement, as compared to 63% of women. About 29% of women farmers report only a medium level of involvement, compared to 9% for men. Community belief mirrors this, as seen in **Table 1**.

Plowing is seen as an activity almost exclusively associated with men. Women are believed to have no knowledge with respect to when, how often, and how to plow the land. One male farmer noted, "Women are not born for plowing, rather their main responsibility is preparing food. I have never seen a woman plowing since my childhood. Actually they can't do that physically, they may not be able to do even a single line." One male farmer noted that any female involvement would bring him shame, "I would even be ashamed if my wife carries plowing materials when we walk together to our plot of land early in the morning. It is not accepted in this regard.**"**

All family members (including children) participate in clearing crop residue and compacting the soil to make the land ready for sowing, which is seen as a crucial step that requires a high level of involvement. Using hoes, women and sometimes children separate the grass from the soil while men engage in plowing the land in other areas. As a male farmer explained, "before sowing, the land has to be compacted through human resources or using cattle, and this is mainly the responsibility of women and children. This implies the involvement of the women is high as they are contributing a lot." A woman farmer agreed, stating, "husband, wife, and children… everyone works on the field. The only difference is that it is only the husband who plows the land. There is nothing else we don't do." So while plowing is seen as a strongly male-dominated activity, land preparation is seen as a family affair.

Sowing

Almost all men (98%) report being personally involved in sowing, as opposed to 59% of women farmers. 87% of male farmers report a very high or high degree of involvement, and 10% report medium involvement. Of the women involved in sowing, 68% report a high or very high

level of involvement, while 31% report medium involvement.

Both men and women perceive teff sowing as a male-dominated activity, with some involvement of women. Farmers indicated that women are involved in sowing, and play a key role particularly for sowing in rows. Since it is seen as a labor-intensive activity, the involvement of other household members is crucial, as explained by a male farmer, "no matter the method, row based or broadcasting, women are highly required to be part of the activity. For example, when sowing in rows, the women prepare lines so that we can sow teff seed. The line is made by the women through dropping leaves in rows. Here it is a must for the women to be there.**"** For broadcasting, women pass the seeds while the man sows. Women are also in charge of preparing and cleaning the seeds for sowing, and coordinate with men for sowing in rows.

> *"The woman and the farmer (the husband) go out to sow together. This is because they plant in rows. He will not plow and then just stop. When he plows, you have to apply the fertilizer and the seed right away. When using broadcasting, you can take your time to start sowing. But row planting is different. It requires more coordination between the one who plows, the one who applies fertilizer and the one who sows the seeds."*
>
> **— IDI with female farmer**

Fertilizer Application

Both men and women report men being more involved in fertilizer application than women. Almost all men (98%) and more than half of women (53%) report being personally involved in fertilizer application. Community belief are similar, as shown in **Table 1**.

Since fertilizer can be applied at multiple stages in the teff growing season, perceptions of involvement may also differ depending on the moment in time when farmers are asked the question. For example, our qualitative findings indicate women are heavily involved in applying fertilizer at the sowing stage. As a male farmer described the process, "in case of sowing, especially when we sow using the row method, my wife puts the fertilizer in a row. I do the sowing of the teff seed". However, later on in the season, monitoring the crops and applying fertilizer appears to be an activity associated with men, as explained by a male farmer, "it is the man who mainly works on the field. We plough the land 5 times. We are the ones who apply fertilizer". Men are also usually in charge of purchasing fertilizer.

Weeding

Weeding is seen as an activity where almost universally both men and women are involved. Almost all men (100%) and women (99%) agree that men participate in weeding. The figures are similar with respect to women's level of involvement. Our qualitative findings indicate that all family members are heavily involved in weeding since it is labor-intensive. As a male farmer explained, "These are important events in our farming activities, as weeding needs the involvement of all family members. Sometimes, weeding is even more of the responsibility of the women and children." This is particularly true for weeding by hand, which is a women-dominated activity.

However, weeding using herbicide appears to be an activity associated with men. As a woman farmer explained, "Sure he is the one who checks and sprays chemicals but I participate in the rest of the work as well." Another male participant agreed with her: "It is us, the men, who manage the teff plots. I go out and inspect the field…I then spray chemicals if needed also."

> *"For example, we men will be feeding cattle or doing some other work until 3.00 in the afternoon and then we come back home. But the women will be up early, cook food for the family and then go to the field to do weeding. They stay out weeding until it gets dark. Their role is greater in weeding."*
>
> **— Male participant, mixed-gender FGD**

Pest Management

Very few people in our sample report being involved in pest management, despite high perceived levels of involvement for both women and men. Only 18% of the men in our sample and 6% of women report being personally involved in pest management (n=139). Of those involved, men are perceived to have higher participation in pest management.

Harvesting and Threshing Teff

Harvesting is an activity where both genders are almost equally involved. Almost all (97%) men and women (92%) report being personally involved in harvesting teff. Of those involved, 83% of men and 68% of women report a very high or high level of participation and this difference is statistically significant. As seen in **Table 1**, all men and women (100%) agree men are involved in harvesting teff. Almost all men and women (99%) believe women are involved in harvesting teff.

Threshing is an activity with high involvement from men and women. 97% of men and 82% of women reported personally participating in threshing, which is similar to the community perceptions shown in **Table 1**. More men than women reported a very high or high level of involvement: 80% of men versus 64% of women.

Threshing appears to be more male-dominated than harvesting. Here, a man's role is to trample the teff using cattle and separate the grain from the straw, while women support by preparing food and drinks for hired laborers or for trading labor (an arrangement called wonfel - ዎንፈል). Women also clean and prepare the threshing area. As a woman farmer explained, "The women are less involved in this regard, because threshing is actually [done] made by men, we rather prepare the place where threshing takes place, and transport the yield home."

Women and their husbands talk about how and when to do harvesting and threshing. At the harvesting stage, women are involved in cutting the teff straw using sickles and collecting the harvest from the plots. As a woman farmer explained, "Of course I participate! If I see that the rain is coming, I pick up my hand-sickle, call my children and join my husband for harvesting." Male farmers too confirmed that women and children are involved in harvesting teff, "Harvesting is [done] together, the women support in cutting and collecting it to pile up, whereas men do mostly cutting, piling up, and threshing."

Food preparation is also a key element of both harvesting and threshing. As harvest activities usually involve trading labor and cattle with neighbors (wonfel) or hiring labor, women's role is to prepare food and drinks, without which harvesting cannot begin. These cultural norms imply women are central to harvesting and threshing. A woman farmer noted, "Well, isn't everything dependent on the women? Harvesting begins once the women prepare food. Whether it is during labor exchange or when labor is hired, food needs to be ready to be served for those who do the harvesting. The food preparation is even more expensive than the payment for labor."

Men and women's roles are different, but complementary, and most respondents acknowledge the other gender's contributions.

> *"We talk about which date to start the work… She then prepares the food and drink. She tells me when it will be ready…"*
>
> *"Preparing the floor for threshing…that is their responsibility (the women's). They do most of the work."*
>
> **— Male participants, mixed-gender FGD**

Storage, Sale, and Post-harvest Management

Almost all men and women (97%) report being personally involved in teff storage and post-harvest management. Men are significantly more likely to report a high or very high level of involvement (78% for men and 65% for women), while women are more likely to report only medium involvement (33% of women and 20% of men).

Men and women decide together how much of the harvest to keep for consumption or as inputs for next year, and how much to sell. Once the teff has been divided, women have responsibility over teff storage, while men manage the sale of teff. Teff is traditionally stored in facilities such as gota or dibignit, or in sacks inside the house. Women are in charge of administering how the teff is used, both for the household's consumption, and in terms of seed management as inputs for the next harvest. A male farmer explained, "Once the crop is allocated for consumption, the women are fully responsible to manage and decide whatever she wants to do. I do not ask her about it, whatever happens to it, she may sell, or make it all to be consumed or anything else." A woman farmer elaborated on men and women's responsibilities, "The small amount of teff that remains…the husband will give it to his wife so that she puts it away. She won't touch that teff no matter how bad she needs money. When it is time to pay for the fertilizer, she says they should sell the teff and buy fertilizer and he will do that." From the qualitative results, we can see that while men may say the stored teff belongs to the woman, the use of that teff is for the household.

Our qualitative research shows that men are in charge of selling large amounts of teff (over 50kg), while women are free to sell smaller quantities of teff from the teff set aside in storage. Men who sell large amounts of teff will use the money to purchase inputs (e.g., fertilizer, improved seeds) or for covering large expenses or investments. Women use the income from small quantities of teff to purchase household goods and food items. In the end, men control a large proportion of the income earned from a teff harvest, although social norms dictate how that income should be used for the household and for inputs for the next agricultural season.

View of Self as Farmer

Almost all men (97%) of men and most women (88%) report feeling confident in applying new teff practices on their plots. Similarly, almost all men farmers (95%) believe they are improving as teff farmers, as compared to 89% of women farmers. However, women's perception of self-confidence as farmers is significantly lower than men. Using a logistic regression model,[62] we analyzed drivers of self-confidence in teff farmers. Wealthier farmers are significantly more likely to feel confident applying new practices, as well as farmers who have had a woman DA in the past. Access to information on teff is also positively correlated with self-confidence.

> "*#3: "He sells the teff…to cover fertilizer expenses."*
>
> *#4: "We don't sell teff. Not unless it is for buying food. Women sell small amounts of teff to buy things like oil or salt. But there are husbands who buy things like coffee, oil, onion…"*
>
> *#2: "It depends. There are some men who know how to buy such things for the household, and others who don't. Some men sell the teff and buy what is needed. Others, …their wives will do the buying."*
>
> *#5: "I don't sell teff. He does. He spends it on fertilizer and if some money remains, he buys improved seed.*"
>
> **— Female participants, women-only FGD**

Women are significantly less likely to feel confident in applying new practices, having only 30% of men's odds to feel confident in their abilities. When running the regression only for the women in the sample, we find the only determinant of women's confidence in their abilities as teff farmers is having a woman DA. Women farmers with a woman DA are twice as likely to feel confident in their abilities than women farmers with a male DA. Our section below on farmers' relationship with DAs explains this association in more detail.

Self-improvement and self-confidence can largely be determined by internalized cultural norms. Both men and women share the belief that male farmers are more knowledgeable, either because women have other responsibilities to attend to besides farming, or because of their upbringing, which prepares men better for managing farming activities. A woman farmer noted women have less knowledge as they tend to stay at home and be less involved in farming, "How would a woman know what to do about farming? Women don't know. The men know. Since I also have children to take care of, I spend most of the time at home." As a male farmer explained, "For men it is easier to adopt new technology and practices, because unlike the women, men are raised that way starting from their childhood." Another woman farmer agreed: "It is incomparable, men are better. Men are better in all circumstances in managing farming activities, either to manage the usual agricultural activity plus to adopt the new best practices." Internalizing these preconceptions can hinder women from believing they can improve as farmers, or from feeling confident in their abilities to match men's level of skills and knowledge.

Women who participate in teff farming activities also expect their communities to have a lower perception of their abilities as teff farmers. 96% of male teff farmers believe that their community respects them as teff farmers, as opposed to 76% of women teff farmers. The difference is highly statistically significant. Using a logistic regression model, we find that wealthier

[62] Controlling for education level, gender, participant age, kebele code, gender of the DA, farmer wealth, access to information on teff farming, attending teff training, and sampling design.

farmers are more likely to believe they are respected in the community. Access to information on teff farming is significant and positively correlated with perceptions of respect. Social groups appear to have the opposite effect; controlling for the number of social groups a farmer belongs to, we find that participants who do not belong to any group are significantly more likely to believe they are respected as farmers. This effect holds when running the regression only on the women in the sample; women who do not belong to any social groups (n = 60) are 4.7 times as likely to feel respected as a farmer in their community as compared to women who belong to any group. Women who are members in mutual help/insurance or civic/charity groups are more likely to feel disrespected in their community. The opposite effect holds for men: belonging to agricultural, trade or mutual help groups is positively associated with perceptions of respect.

These perceptions of lack of respect, paired with lower self-confidence and lower belief in one's ability to improve as a farmer, is influenced by gendered cultural norms, which in turn can be reproduced in social groups. Using insights from focus group discussions, we find evidence that women are perceived to be less effective teff farmers, particularly by men. Farmers volunteered multiple opinions on why men farmers are superior (some are shown below).

> "*No matter how brave you are, no woman is strong" - (ምንም ጀግና ብትሆን የሴት ብርቱ የለም)." So, no matter how smart a woman is, the women are not strong enough to manage activities like men*"
>
> **— Participant, male-only FGD**
>
> "*A household that has a weak male farmer is better than a household that has a strong and committed woman farmer. Women are not aware of different farming activities. Men and women are not comparable. Women are not even effective in managing the family*."
>
> **— Participant, male-only FGD**
>
> "*Men who are enrolled in extension service are better because they are active enough in implementing different farming activities. In terms of improvement in life, a household led by men is better than a household led by women. Men are good in every context.*"
>
> **— Female participant, mixed-gender FGD**
>
> "*The women can do nothing; they always ask men about what to do. I have one sister and she is the household leader by now but she always comes and asks me for each and every farming activity. They know nothing about outdoor farming activities. Even frequently the women are called for training but they do not come and attend*."
>
> **— Participant, male-only FGD**

Findings on Research Questions

We now present the findings of the study, structured around the three research questions. Within each section we provide a discussion of the results, then conclude with recommendations for SAA and areas for future research.

RQ1: Drivers of Best Practice Adoption

The primary research question of the study asks:

What gender-specific factors (e.g., decision-making power, access and control over inputs and information) drive the adoption of BPs in teff farming households in Ethiopia?

In this section we present the findings from our plot observations in Gonji Kollela and Yielmana Densa, reporting the rates of adoption for the 20 best practices observed and evaluated – from land preparation to harvesting. We pair these observations on best practice adoption with the gender-specific factors and household characteristics which were collected for each household. Using econometric analysis, we highlight any gender-specific factors or household characteristics that are statistically associated with higher or lower adoption of specific best practices. These quantitative findings are supported by explanations given by farmers, DAs, and crop experts in the qualitative FGDs and interviews.

Before assessing the drivers of best practice adoption, we first report descriptive statistics on the rates of adoption for 20 best practices which were observed through teff plot visits. These plot visits were conducted during the quantitative survey in all three rounds of data collection to allow the direct observation of best practice adoption at the various phases of the season. These visits were conducted with one household member (the manager of the plot, usually a man) on the households primary teff plot.

*Note: **Appendix 1** provides the complete details on the best practices, their adoption criteria, and their rates of adoption.*

Best Practice Adoption Rates

Some BPs are readily adopted by all households, while some BPs are very rarely adopted. For example, BPs relating to harvesting, threshing, and storage methods were adopted by 100% of households, whereas less than 10% of households weeded at the correct frequency, used sowing in rows, or used the correct amount of seeds. **Figure 24** below details the percentage of households who have adopted each of the 20 best practices observed in the study, sorted by most adopted to least adopted.

The average household is adopting 9.2 out of the 20 BPs observed in the study. The highest adopting households adopted 15 of the 20 practices, while the lowest adopting households adopted 4 of the 20 practices. The majority of households (51%) were adopting either 8, 9, or 10 of the 20 BPs. Households in Yielmana Densa adopted more BPs (9.5 out of 20 on average) than households in Gonji Kollela (8.9 out of 20 on average), but this difference is not statistically significant.

Figure 9: Percentage of households adopting individual best practices (n=555)

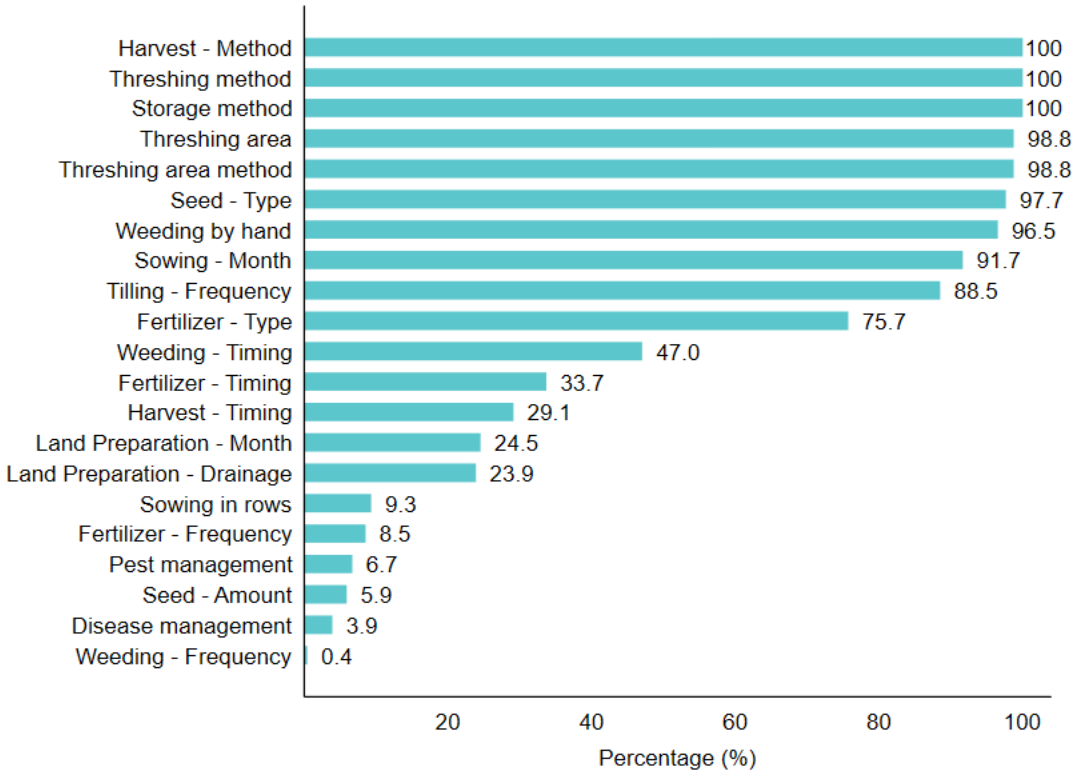
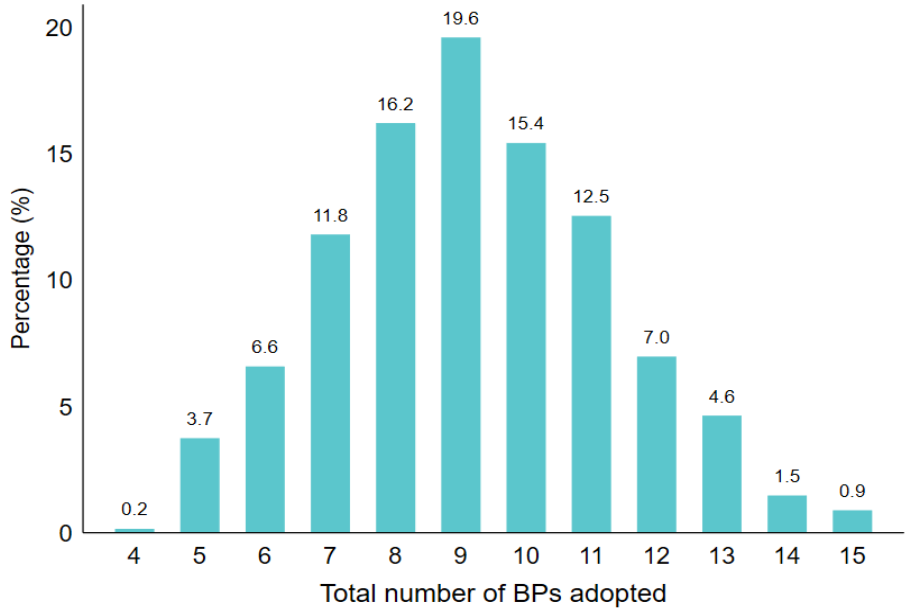


Figure 10: Distribution of total number of BPs adopted by households (out of 20) (n=555)



Gender-specific drivers of BP adoption

Using regression analysis, we examined variables associated with a household adopting more best practices in general. Not every best practice is created equal. Given the diverse set of best practices examined and the potentially different factors associated with their adoption, it is important to look both at aggregate adoption of best practices, as well as at each practice individually to determine if there are specific gender drivers of adoption for each practice. As discussed in the sections on gender roles and decision-making, men and women have different levels of involvement in various teff activities, and different levels of decision-making power, which may influence the adoption rates of individual best practices differently. Therefore, our analysis focused on general drivers of best practices, as well as on drivers of the adoption of individual best practices (rather than the sum of best practices). We analyze these heterogeneous effects in the sections below.

This section reports the results of the econometric analysis on drivers of best practice adoption for each individual best practice. Unless otherwise stated, the models were estimated using a multivariate logistic regression, controlling for gender, age and education of the respondent, number of household members, household wealth, farm size, gender of the DA, decision-making and empowerment indicators, and sampling design. **Table 3** provides a summary of the gender-specific and control drivers for all 20 BPs which is followed by detailed explanation and discussion.

Having more access to information for decisions on teff farming is strongly associated with more adoption of best practices, for both women and men

Women and men were asked individually to assess their extent of access to information in order to make decisions on teff farming – on a four-point scale from “not at all” to “a high extent”. For both women and men, having higher access to information was strongly associated with the household adopting more best practices for teff farming.

This finding is consistent with the existing literature on best practice adoption. Lack of access to information has commonly been found as a major barrier to the adoption of best practices,[63] [64] with more information being positively associated with adoption, as confirmed in our study. From a gender perspective, Ragasa[65] identified limited access to information or low literacy rate to use the information as the number one constraint for women in adopting BPs. Weaknesses in education and extension systems means millions of women and men lack the literacy, training, and skills needed to increase their agricultural productivity. Women farmers generally have lower education levels, which is also confirmed in our study, which can affect their understanding and adoption of BPs especially if the technology requires use of more technical and intensive knowledge.[66] This issue is exacerbated in rural areas, where poor rural women tend to be underserved by both the education and extension systems. As confirmed in our study, rural women in many parts of Ethiopia also attend far fewer extension trainings than men, meaning women’s access to information is lower than their male counterparts.[67] Although it wasn’t directly explored in our study, lack of intra-spouse communication can also be a barrier to information

[63] Kariuki & Mwangi. (2015). Factors Determining Adoption of New Agricultural Technology by Smallholder Farmers in Developing Countries. Journal of Economics and Sustainable Development. Vol.6, No.5, 2015. https://core.ac.uk/download/pdf/234646919.pdf
[64] Arslan, A., Floress, K. Lamanna, C., Lipper, L., Asfaw, S., & Rosenstock, T. (2020). The adoption of improved agricultural technologies: A meta-analysis for Africa. IFAD.
[65] Ragasa, C. 2012. Gender and Institutional Dimensions of Agricultural Technology Adoption: A Review of Literature and Synthesis of 35 Case Studies”, for IAAE Conference. August 18-24, 2012, Foz do Iguaçu, Brazil. https://ageconsearch.umn.edu/record/126747/
[66] Ragasa, C. 2012.
[67] World Bank and IFPRI. 2010. Gender and governance in rural services: Insights from India, Ghana, and Ethiopia. Washington, DC: IFPRI and World Bank.

access, as it is common for only one household member (usually a man) to be trained in extension programs. As a result, information on BPs does not always cascade to all household members (often women) who are dependent on their spouse to receive information.[68]

This finding is important for Sasakawa, as contact with SAA-trained DAs through trainings is a source of information for teff farmers. Our data shows a strong association between training attendance and access to information. This signifies a potential channel of influence the SAA may have on household BP adoption. This hypothesis is explored further in RQ3.

Having more control over teff income or teff output (i.e., whether to consume it or sell it) is associated with less BP adoption for women, and more BP adoption for men.

Women and men were asked individually to assess their level of input into decisions on how the income from teff is used and on their level of input for whether to consume or sell the teff output. Responses were measured on a three-point scale from "little to no input" to "input into most or all decisions". We find that more control over income or teff output is associated with more adoption of BPs when men are in control, and less adoption of BPs when women are in control. This finding is highly statistically significant for both women and men and is robust to various measures of control over income, including the Pro-WEAI methodology.

This finding is driven by specific BPs where men culturally have more involvement, such as harvesting or fertilizer application. As detailed in the gender roles section, men are in charge of hiring or trading labor for harvesting, and also go to the market to purchase fertilizer. Both these activities require a significant share of the household's income, and it is typically the man who completes the transaction. In terms of selling versus storing teff, areas of responsibility are also divided, with men generally selling large amounts of teff and using the resulting income to purchase agricultural inputs such as fertilizer, while women are primarily in charge of storing teff and selling small amounts in order to buy household consumption goods. These normative roles might explain why men's control over the use of income from teff is significantly associated with choosing the right fertilizer type or harvesting teff at the right time, while women's increased control over income from teff has a negative impact on the adoption of these BPs. Decision-making and control over the use of income are analyzed in more detail in the next section on intra-household decision-making.

More decision-making power on teff farming is generally associated with more BP adoption when men make decisions. For women, findings are mixed.

Men having more input into decision-making on teff farming is positively associated with harvesting at the right time, while the opposite holds for women. In terms of decision-making on individual best practices, the impact of women making more decisions is mixed. For instance, when women who attend training on sowing have more input into decisions on sowing, households are more likely to adopt sowing in rows, a key best practice. This finding should be interpreted with caution, as the sample size is low, but could be explored in future research. However, when women have more input into weeding or harvesting decisions, households are significantly less likely to weed or harvest teff at the right time, and less likely to weed the recommended amount of times. The opposite holds for men: more input into decision-making is positively associated with harvesting teff at the right time.

[68] O'Brien, C., Gunaratna, N.S., Gebreselassie, K., Gitonga, Z. M., Tsegaye, M., & De Groote, H. (2016). Gender as a Cross-Cutting Issue in Food Security: The NuME Project and Quality Protein Maize in Ethiopia. https://onlinelibrary.wiley.com/doi/abs/10.1002/wmh3.1

There are several potential explanations for these mixed findings. As detailed in the gender roles section, men and women have different levels of involvement into various teff farming activities, with women being more involved in activities such as weeding by hand or sowing in rows. These BPs are also particularly labor-intensive, with farmers commonly reporting that they lack the labor force or time resources to implement them. Weeding is an activity with high involvement of women, and also a labor-intensive and tedious activity. While we do not have evidence to prove this, it could be that when women have decision-making power, they prefer to limit their exposure to this drudgerous activity for which they perform the larger share of the work. Time use is another important factor which was mentioned in the qualitative study as preventing farmers from weeding by hand. Women's time is typically also occupied with childcare, food preparation, and other household tasks which greatly limit the amount of time to spend on weeding. Women decision-makers may be prioritizing these activities over weeding. This requires further investigation.

Weeding & Time Use

In addition to more labor, weeding by hand also takes more time. Farmer time is already occupied with numerous other activities, and recommended time frames for weeding are short.

Women's time is already at a premium, as they are usually responsible for childcare, food preparation, and numerous other household activities. Weeding is also the teff practice where women are most involved.

"One farmer may grow teff about 0.5-0.75 hectare of land, thus they cannot manage weeding only through manual method within the recommended weeding time framework. As the result, they use chemical to address all plot of land."

– DA

Although our study did not investigate time use directly, future studies could look at this important factor as limited time is likely a driver for non-adoption of some BPs.

In terms of harvest timing, as discussed in the gender roles and decision-making section, women commonly dictate when harvesting begins, as it is linked to food preparation. As one female farmer states, "harvesting begins once the women prepare food." There is a possibility that that social norms and roles are a bigger determinant of harvest timing than the recommended best practices. Meanwhile, as men are in charge of hiring or trading labor with neighbors for harvesting, increased participation in decision-making could translate into more influence on when the community harvests. Decision-making on teff farming in general, and on individual teff best practices, is explored in more detail in the following section on intra-household decision-making.

Having more household members and having more wealth tends to be associated with more BP adoption, for both women and men.

This finding is consistent with the existing literature[69] [70] on best practice adoption. Having more household members and more wealth is commonly associated with more best practice adoption.

[69] Mignouna, B., Manyong, M., Rusike, J., Mutabazi, S., & Senkondo, M. (2011). Determinants of Adopting Imazapyr-Resistant Maize Technology and its Impact on Household Income in Western Kenya: AgBioforum, 14(3), 158-163. http://hdl.handle.net/10355/12461

[70] Arslan, et al. (2020). IFAD.

For household members, the main explanation for this is the availability of labor, which is required to adopt many best practices. Some best practices (e.g., sowing in rows; weeding by hand) are very time consuming, and require the help of the whole family. From a gender perspective, these time consuming activities also tend to be primarily women's roles. Lack of access to labor is a major constraint for BP adoption for women.[71] Across sub-Saharan Africa, women are often disadvantaged in their access and control over labor and income, so having more family members can provide an additional source of labor. For wealthier households, they are likely more able to take risks and implement time consuming and costly best practices.

When looking at individual best practices, we find a positive association between the number of household members and the frequency of tilling for land preparation, as well as the frequency of fertilizer application, an effect that holds for both men and women. Wealthier farmers are also more likely to till the recommended number of times. Land preparation is a particularly time consuming best practice, so households with more wealth may be able to hire day labor, or get additional support from other household members.

Training attendance is associated with more BP adoption for women when the training focuses on activities where women play a bigger role (e.g., weeding, sowing in rows)

Women and men were asked about their attendance to DA-led training sessions. We asked about attendance to training both in the current meher season, as well as if the participant has ever attended training in their lives. If the participant attended, we also asked specifically about which sessions they attended and which topic was covered (e.g., land preparation, weeding). We find some significant results for women, showing an association between training attendance and more adoption of those best practices. For weeding, we find that when women have ever attended training in their lives they are twice as likely to weed more frequently. For sowing in rows, we find that when women have attended training in their lives, or have attended training specifically on sowing this meher season, they have close to five times the odds of attempting to adopt sowing in rows.

Interestingly, these findings appear to hold only when women are trained; we do not find similar associations when men are trained on these practices. One potential explanation are community normative gender roles, as both weeding and sowing in rows are practices where women are more likely to play a role. It suggests that when women get access to information through training, they act on that information if it relates to activities they are responsible for. These findings are further explored in the third research question.

For sowing in rows, this association might also be due to the technical nature of the BP and the very nature of teff itself – a small seed. It is already common to plant other crops like maize or wheat in rows, but farmers find it odd to plant a small seed like teff in rows, as confirmed in our qualitative study. Some farmers believe that broadcasting is a better method, as explained by a male farmer, "I believe broadcasting is still the practice that has higher yield. If we apply enough fertilizer, broadcasting is better." A female farmer explained that this is due to a lack of knowledge, stating that, "The people in our village don't know about planting in rows. We don't know about it…about farming. …We don't know any different." Given this, it stands to reason that when women attend training, they are provided access to information on a practice that otherwise would not even be considered. This theory is reinforced by the finding that access to information is also strongly associated with higher adoption.

[71] Ragasa, C. 2012. Gender and Institutional Dimensions of Agricultural Technology Adoption: A Review of Literature and Synthesis of 35 Case Studies", for IAAE Conference. August 18-24, 2012, Foz do Iguaçu, Brazil. https://ageconsearch.umn.edu/record/126747/

Having a female DA has mixed impacts on BP adoption.

Having a woman DA is positively associated with sowing teff in the right month and weeding teff at the recommended frequency — women who are trained by a woman are three times more likely to sow teff at the right time than women trained by a male DA ($p = 0.05$), and twice as likely to weed teff more frequently. However, women trained by a woman DA are significantly less likely to harvest teff at the recommended time. For men, the impact of having a woman DA appears to be negative: men trained by a woman DA are significantly less likely to sow teff in rows.

These findings should be interpreted with caution, as we do not have a large enough sample of DAs (11 women DAs and 12 male DAs). Furthermore, as DAs tend to operate in specific kebeles, controlling for the impact of the DA variable may also capture location-specific effects and geographic heterogeneity. This being said, our qualitative information on farmers' relationship with DAs suggests that DA do have influence on the adoption of teff best practices and play a critical role in the effectiveness of training. The quality of training and content that DAs receive from SAA is another direct link to households. DAs can play a pivotal role in a household's BP adoption decisions, as they often are the first source of information and knowledge on BPs for farmers. Some households exhibit trust in their DA, and adopt the practices shared, while others are skeptical. This DA-farmer relationship is therefore crucial for influencing adoption, and SAA plays a pivotal role in training DAs.

Many farmers in the focus group discussions trusted the DAs and crop experts. One male farmer explained, "I always implement any new practices advised by DAs and other experts. I do not refuse from applying what they teach us." Another farmer added, "I personally believe that improved seeds and other agricultural inputs are supplied by the government after intensive investigation and experiments. As a result, I always want to adopt the new practice recommended by kebele level DAs as well as crop experts."

However, some farmers were skeptical about DAs, and were reluctant to adopt the recommended practices**.** One male farmer in Yielmana Densa believes that "most farmers assume that they are better than DA workers in farming practices. They presume that they have more knowledge and practical experience than the expert. "We assume that we are beyond and above the government. Thus, we do not accept what they said regarding different farming practices and new recommended best practices. This shows that agricultural experts need to show their performance practically for the farmers." In terms of the gender of the DA, our qualitative data also showed that farmers are more skeptical of women DAs, believing them to be less knowledgeable at times and sometimes even refusing to take their advice. These findings, and farmers' perceptions of make and female DAs are explored in detail in the section on SAA's impact on extension training.

In light of our findings showing lower BP adoption on harvesting and sowing in rows for households trained by women DAs, it is possible that gender norms could be influencing the quality and perception of the training they provide and their motivation. Gender roles and norms may also play a role for the DA's delivery of training content, as harvesting is an activity typically associated with men. This may lead to women farmers being generally less inclined to accept advice on a male-dominated practice from a woman. A similar effect could be at play with respect to male farmers and sowing in rows. The choice of the sowing method (broadcasting or sowing in rows) is typically decided by the man, a process explained in more detail in the section on intra-

household decision making. It could therefore be possible that men farmers too are less willing to accept advice on an area that is considered their field of expertise from a woman.

In terms of the influence of women DAs on weeding, we similarly do not have evidence to draw any final conclusions. However, one hypothesis might be that when working with women DAs there could be a role model effect[72] at play, where women are more keen to emulate the recommendations of their peers. It could also be that in local gender norms women are seen as more involved in weeding (compared to other activities like land preparation), so the advice of a woman is seen as more trustworthy for this practice. This requires further exploration. Our qualitative research also showed that women DA's appear to focus less on teff farming and more on teaching gender-specific practices, such as cooking technologies, preparing compost from household residue, or weeding, all of which are activities traditionally associated with women's roles. It is unclear whether this is the case because women DA's lack knowledge on other teff farming practices, or because they tailor their training content to fit the audience's gender norms. We do not have the data to confirm these hypotheses in our study, but these could be interesting future areas of research for SAA.

Membership to community groups is significantly associated with adoption for some BPs, and significantly associated with non-adoption for others

Women and men were asked about their membership to various community groups, including women's groups, microfinance groups, religious groups. Existing literature[73] frequently shows a positive relationship between more group membership and BP adoption. This is commonly explained through a pathway of information sharing, as people in social groups are more likely to converse with other farmers and DAs. We found mixed effects when looking at the association of group membership and BP adoption for women and men – some positive and some negative.

For women, being members of more groups is associated with more adoption of the harvest timing best practice, but less adoption of recommended practices for weeding frequency and timing. These are all practices where women commonly play an important role. As described in the section on gender roles, harvesting often commences when women have prepared food for the laborers. It could be that women in social group settings are influenced by other women in the groups to coordinate food preparation and harvesting at recommended times. Harvesting is also a team effort and community event, often requiring support from the whole family and neighbors. This might explain why being a member of community groups is linked to the recommended timing of the harvest. For weeding, it is unclear why group membership would be associated with less adoption of recommended practices.

For men, being members of more groups is associated with more adoption of the harvest timing best practice (similar to women), as well as more attempts to adopt sowing in rows. Again, harvesting is a team effort, often involving the whole family and members of the community, so group membership is likely male farmers' direct link to the community. For sowing in rows, male farmers in our qualitative study commonly expressed skepticism about the practice, especially for teff. One hypothesis for our findings is that social connections through group membership may be reducing skepticism on the practice, as men hear of other households who have adopted the practice and improved yields. These hypotheses could also be examined in future studies.

[72] Lecoutere, Els; Spielman, David J.; and Van Campenhout, Bjorn. 2019. Women's empowerment, agricultural extension, and digitalization: Disentangling information and role model effects in rural Uganda. IFPRI Discussion Paper 1889. Washington, DC: International Food Policy Research Institute (IFPRI).
[73] Feyisa, B. (2020). Determinants of agricultural technology adoption in Ethiopia: A meta-analysis, Cogent Food & Agriculture, 6:1, DOI: https://doi.org/10.1080/23311932.2020.1855817

Drivers of Adoption of Specific Best Practices

Note: **Appendix 1** *provides the complete details on the best practices and their adoption criteria.*

Table 3: Drivers of BP adoption by best practice

(+) Positive association to adoption of best practice
(–) Negative association to adoption of best practice

	Women	Men
BP1 Month land prepared	None.	None.
BP2 Frequency of tilling	(+) More HH members)	(+) HH wealth
BP3 Drainage practices	Adopted by only 84 households; not enough variation to determine drivers.	
BP4 Sowing month	(+) DA is a woman (+) HH wealth	(–) Nr. of group memberships
BP5 Improved seeds	Adopted by 98% of households; not enough variation to determine drivers	
BP6 Sowing in rows	(+) Attendance to sowing training (n=30) (+) Training attendance (+) More access to information (+) Women who attended sowing training more involved in sowing decisions	(–) Participant age (older) (–) DA is a woman (+) Attendance to sowing training (n=200) (+) Nr. of group memberships
BP7 Seeds amount	None.	None.
BP8 Fertilizer type	(–) Distance to main road (+)More access to information	(–) Participant age (+) More control over income
BP9 Fertilizer frequency	(–) Distance to main road (+) More HH members	(–) Distance to main road (+) More HH members
BP10 Fertilizer timing	None.	None.
BP11 Weeding method	Adopted by 2% of households; not enough variation to determine drivers	
BP12 Weeding frequency	(+) DA is a woman (+) More access to information (+) HH wealth (+) Training attendance (–) Women more involved in weeding decisions (–) Nr. of group memberships	(+) More access to information

BP13 Weeding timing	(+) Training attendance (+) More plots (–) Women more involved in weeding decisions (–) Nr. of group memberships	(+) HH wealth
BP14 Disease management	Adopted by 3% of households; not enough variation to determine drivers	
BP15 Pest management	Adopted by 6% of households; not enough variation to determine drivers	
BP16 Harvest method	Adopted by 100% of households; not enough variation to determine drivers	
BP17 Harvest timing	(+) Nr. of group memberships (–) More HH members (–) Women more involved in harvesting decisions (–) DA is a woman (–) More control over income	(+) Nr. of group memberships (+) Men more involved in decisions on teff farming (+) More control over income
BP18 Threshing area	Adopted by 99% of households; not enough variation to determine drivers	
BP19 Threshing method	Adopted by 100% of households; not enough variation to determine drivers	
BP20 Storage method	Adopted by 100% of households; not enough variation to determine drivers	

Discussion & Further Analysis

The impetus for this study was to understand what drives a teff farming household to adopt best practices, and if any of those drivers had a gender component. Our hypothesis was that certain gender-specific factors and intrahousehold dynamics might influence adoption decisions. The evidence provided in this section confirms this hypothesis in a limited way. We do find numerous gender-specific drivers of adoption, both on specific best practices and on overall adoption (summation of all BPs). Depending on the practice, access to information for women and men, training attendance for women and men, control over income resulting from teff, involvement of women in decision-making, and having a female DA were all found to be associated with either more or less adoption of some BPs. We also identified numerous control factors – income, education, number of household members, geospatial factors like location and distance to main roads – which are also associated with the adoption of some BPs, often confirming findings already in the literature.

However, while we did find some evidence of gender playing a role in adoption decisions, the evidence is not overwhelming, and some of it requires further investigation. At the outset of the study, we expected intrahousehold factors between women and men (e.g., women's involvement in decision-making) might be a key driver in adoption for some BPs. Women's involvement in decision-making did appear as a driver for weeding frequency, weeding timing, and harvest timing, with households weeding less frequently when women were involved, and less likely to weed and harvest at the recommended time.

Nevertheless, our study has uncovered numerous interesting findings, some of which could be

the subject of continued research. Our study confirms that access to information and training attendance for women and men is clearly associated with more adoption of BPs, and this has clear implications for SAA which can influence access to information through attendance to training and the content of the training, which is discussed more in the section on RQ3. Our study also confirms the association between BP adoption and certain socioeconomic factors like income and number of household members.

Deep Dive: Sowing in Rows

Sowing in rows is a best practice with significant yield improvement potential; it is also one of the most difficult best practices to adopt. Women also play a vital role in the adoption of this BP, as it requires a lot of time and labor to implement, meaning women are often involved. Given its importance, we dedicated a portion of the qualitative research to understand the decision-making process on this BP, as well as challenges faced by women and men when attempting to adopt this BP.

Why Adopt?

Yield improvement was the main reason given by both women and men for adopting or attempting to adopt row planting. A male farmer explains, "the first consideration is always the yield it can give us over the previous [practice]. I personally accept a recommended practice if it is more productive. This is our first criteria."

The decision to adopt is strongly influenced by witnessing the practice in action, either through a DA or a neighbor, or trialing it on a small plot of land. Many farmers remain skeptical about the practice, thinking they won't be able to do it correctly, or it will take too much time and labor. However, some are pleasantly surprised once they try, finding it to be less burdensome than first imagined.

Hesitance & Misconceptions

Despite evidence that planting in rows increases yield, many farmers are still hesitant. It is already common to plant other crops like maize or wheat in rows, but farmers find it odd to plant a small seed like teff in rows. Some farmers debate whether row planting is in fact more profitable, noting that while yield is higher, expenses are also higher, and that the net result is not better than broadcasting.

Other farmers have misconceptions about the practice, which could be alleviated through training. For example, farmers see the space between rows as wasted space, and believe it leads to more weeds which need to be pulled. Others incorrectly believe that planting in rows requires more fertilizer than broadcasting.

Mountainous and waterlogged plots are more hesitant to adopt. In Gonji Kollela, plots are more mountainous and experience more water logging. Farmers expressed hesitance to adopt row planting, explaining that the practice is not suitable for the area.

Challenges in Applying the practice

- **More labor required.** Farmers noted the process required more labor (4 to 6 individuals) to implement than broadcasting method, and that labor is expensive and scarce.
- **More time required.** Planting in rows takes more time. Farmers (especially women) have other activities (e.g., childcare, food preparation) to attend to, so taking more time to plant in rows has implications.
- **More difficult and tedious.** Some farmers lamented that planting in rows was hard work, with some women being threatened with violence for not being able to complete it. Some elderly farmers also noted it was more difficult for them to adopt, and easier for young people.
- **Negative impact on cattle feed.** This was one of the most common complaints about row planting. Teff straw is typically used to feed cattle. When planting in rows, the teff straw becomes thicker and harder, as it has more space and is healthier. Cattle do not like to eat this thicker straw, leaving farmers to find alternative ways of feeding their cattle.

Note: the DAs we spoke with disagreed with farmers in terms of the challenges. They believe that planting in rows saves labor resources, that the labor is not more tedious or difficult than broadcasting. They also report that the straw can be softened with fertilizer, molasses or water for cattle, and that farmers are using too much fertilizer.

RQ2: Decision-Making on Best Practice Adoption

Intra-household decisions on the adoption of best practices are highly complex, often involving a discussion process between women and men in the household to arrive at a decision. Decision-making power over productive decisions has been identified in the literature as a key component of women's empowerment and is a domain of the WEAI. The second research question for this study asks:

How do teff farming households in Ethiopia decide to adopt, plan to adopt, and finally adopt (or partially adopt) various BPs? How does this differ for households with different characteristics (e.g., socio-economic factors, access factors, intra-household factors)?

During the study, women and men were asked which member of their household is responsible for a variety of household and farming decisions, including the adoption of teff farming best practices. In addition, respondents were asked to share which household members were involved in the discussion leading up to the decision. In order to capture gendered dynamics of decision-making, we administered selected Pro-WEAI modules to both the male and the female respondent in the same household and allowed them to also specify other household or non-household members as the primary decision makers. The Pro-WEAI modules covered in this section include input into productive decisions (on general household activities and teff best practices in particular), access to information that is relevant for decision-making, and control over the use of income stemming from teff farming and other household income-generating activities.

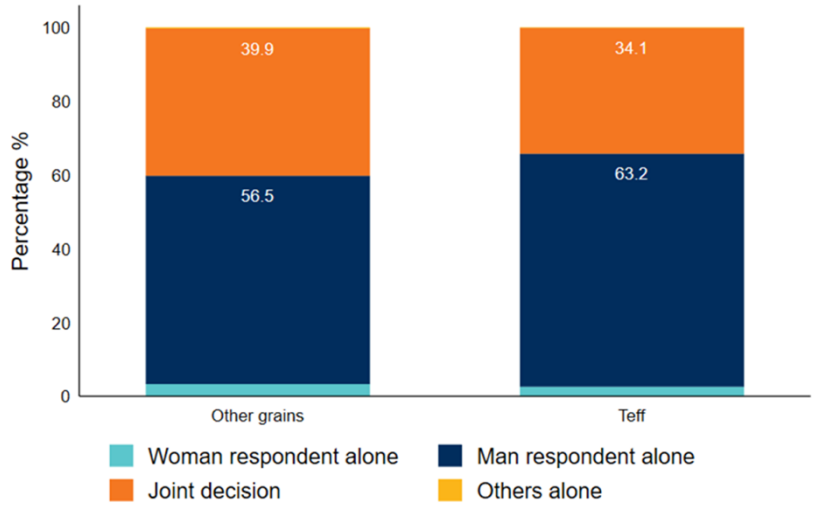
In this section we present our findings on this complex decision-making process, using both quantitative and qualitative data. We provide insights into each phase of the teff growing season, as decision-making differs depending on who is primarily responsible (women, men, or both) for the specific farming role.

Input into Productive Decisions

First, we explore the level of input that women and men have into general productive decisions, including for teff farming. Having input into productive decisions is seen as a key factor in women's empowerment and is a domain in the WEAI.

Men alone are responsible for the majority of productive decisions when farming grains in general, and teff specifically. The male respondent makes the decisions alone in 63% of cases for teff farming, as reported by both men and women in the sample, and 34% report making the decisions jointly. This aligns with the gender roles discussed previously, where despite women's involvement in various stages of teff farming, it is seen as the man's responsibility to lead the process. Couples discuss decisions on teff, since it is vital to coordinate activities with each other, but men are usually the ones making final decisions. A woman farmer explained that, "yes, the women also do participate, but it is mainly managed based on men's plan. The discussion for the women is like the direction we receive to do a particular activity. For instance, if the plan for tomorrow is sowing teff, the men inform the women as well as children to be ready for tomorrow. The same is true for weeding, and other activities." Using a regression model, we investigate the drivers of participation into decision-making on teff farming in general. More educated farmers are slightly more likely to have more input into decisions, a relationship that is weakly statistically significant ($p = 0.07$).

Figure 11: Person Responsible for Decision Making on Farming Teff & Other Grains



Interviewer: "What if you both had different ideas and can't agree on the same thing?

Male: "There is no doubt what I say will be final. If I say no, she will not keep going."

Female 1: "If the man says so, it is final. We follow his lead."

Female 2: "The man knows better about farming."

— Male and female participants, mixed-gender FG

Decision making in other areas, such as household purchases or raising poultry, is reported to be more egalitarian, or woman-dominated. For large household purchases, most men and women report that such decisions are made jointly, following discussions between the two respondents. Women are the primary decision makers with respect to raising poultry and small animals.

Our qualitative findings suggest that although men generally have more decision-making power than women, social norms heavily prioritize consensus and the idea that income resulting from selling teff, livestock, or any other assets must benefit the household as a whole. As a male farmer explained, "Whenever I am ready to sell [teff], she will not refuse. And I will not refuse when she suggests what to do." Another male farmer added:

"Just as every person looks different, the way [households] handle this is also different. There could also be houses where the woman decides. There are families where the man is a good person and the wife is a very bad person. When either of the two are set in their ways, that is bad. It is better to discuss and come to a common decision. I believe that is how most households do it. In the few others where only one partner decides, it is mostly the man who has the final say. Families where the wife has the final say are very rare."

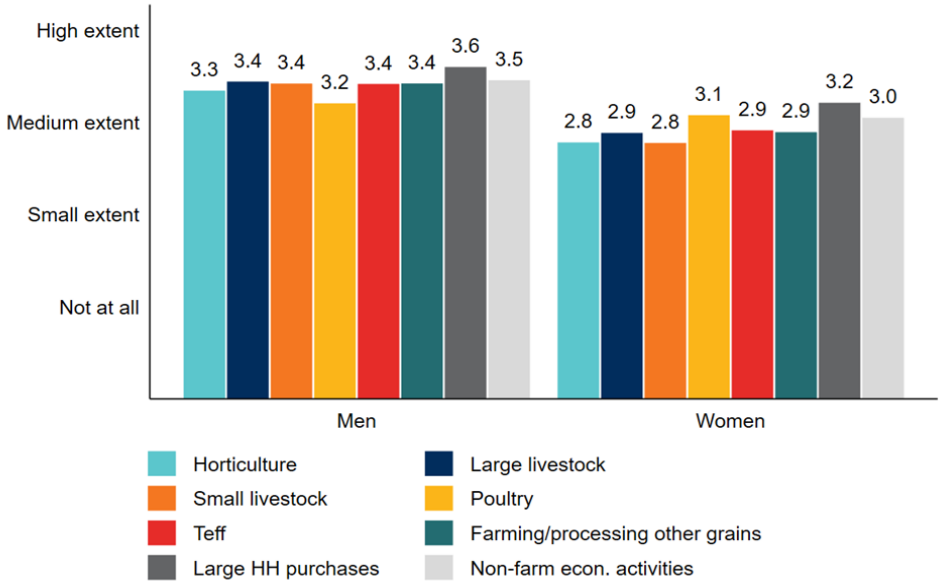
Other male farmers agreed. "Serious discussion is made here when we sell crops. My wife and I discussed in detail about the amount of crop needed for our consumption, amount of crop to be sold, type of crop to be sold, the timing to sell, and other things", noted one farmer. Another added: "When people live together, they have to consult one another. They have to talk about things and

share ideas." While these social norms require men to involve their wives or other female household members in discussions on teff farming and related decisions, the focus on consensus, paired with the gender norms and attitudes presented above in the Gender Roles section may lead to women often capitulating to the man, and deferring to his decision. This norm heavily impacts perceptions around joint decision-making.

Access to Information for Decision-making

There are significant gender disparities in access to information for decision-making, with men consistently reporting higher access to information than women. The gaps are widest and statistically significant for information on horticulture, raising large and small livestock, farming of teff and other grains, non-farm economic activities, and large household purchases. In all these areas, women are significantly more likely to report no access to information.

Figure 12: Self-reported Access to Information



Note: 1 represents no access at all, while 4 represents high extent of access to information

We assessed the drivers of access to information on teff farming[74] and find that women who have not attended any teff training this meher season, women who belong to more social groups, women who cannot access any loans and women living in households with more members are significantly more likely to report no access to information at all. For men, training attendance and being able to access loans are significant drivers of access to information on teff farming. Having a female DA also appears to have a positive, but not statistically significant impact on women's access to information.

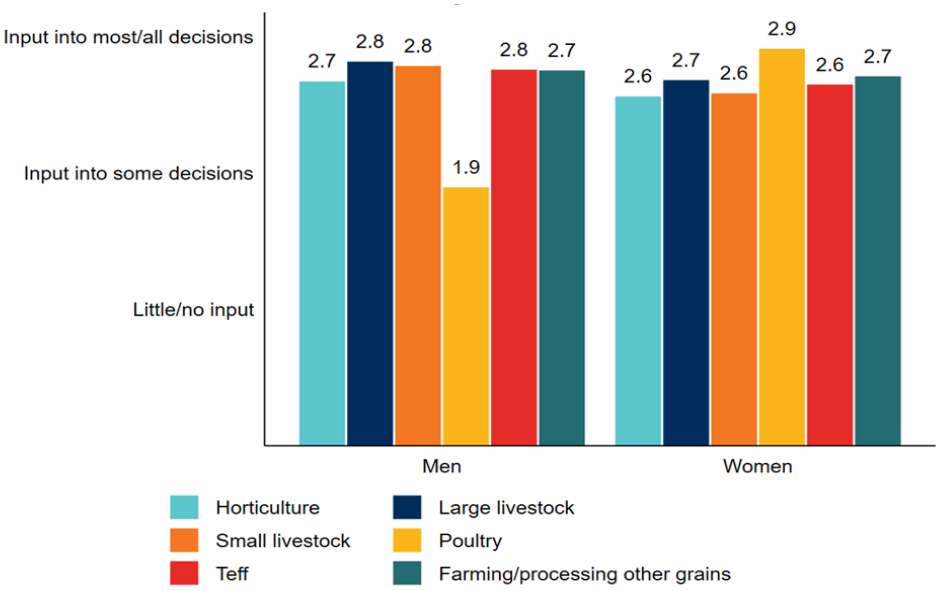
Decision-making over Income Use

Men and women report similar levels of control over income from most household activities and assets. Areas where we find significant differences in favor of men are large and small livestock raising, where men are more likely than women to report having input into all

[74] Regression controls for training attendance throughout the meher season, education level, number of social groups the woman is a part of, gender of the DA, household wealth and sampling design.

decisions on income. On the other hand, horticulture and poultry are women-dominated. Almost all (97%) women report having input into all decisions on income from raising poultry.

Figure 13: Input into Decisions on Income for Various Activities, Disaggregated by Gender



Note: 1 represents little to no input into decisions, while 3 represents input into most/all decisions.

We observed that income from teff farming is primarily controlled by men, as they are the ones selling large quantities of teff following harvesting, and women have some control over income from small quantities of teff, as well as from other crops. Respondents report an understanding that this income will be used for inputs for the next year, or other household purchases, and that a husband should not use the income just for himself. During an interview with a farmer couple, the husband explained that, "This is because we trust each other and know that the other will not do things that are harmful. She sells gesho[75]". The wife added, "The gesho is mine. He doesn't interfere with that. And I don't interfere with his teff."

As detailed in the section on gender roles, women are also independently going to the market to sell small amounts of teff in order to purchase goods for the household's consumption, while men control the income from large-scale teff sales. As a female farmer explained, "He may use [the income from the large-scale selling of teff occurring after the harvest] to pay for fertilizer or to make other payments. He has many such expenses." When asked what would happen if the spouses did not agree on how to spend the money, she added, "The woman gives in. If we refuse to do that and if we are both set on our ways, then the family will be broken. That will be the end. The woman has to give in so that she can raise her children." When it comes to smaller amounts of teff however, women typically control the income resulting from the sale. A woman farmer noted: "We participate in decision making regarding when to sell what little teff is left from being sold to cover fertilizer expenses. That will be what is left for us to use… and we may decide to buy a lamb with the money that we get." Decision-making on selling teff will be explored in more detail below.

[75] Gesho, or shiny leaf buckthorn, is a plant grown in Ethiopia and Eritrea and used for medicinal and nutrition purposes.

Interviewer: "What if the husband insists he will sell the teff?"

Female: "But, the teff is ours (women's) once it is stored."

Male: "There is a story about a farmer where he sings and is playful when plowing, planting and harvesting. Later, when he is threshing, his tone is low (as if he was sad). When people ask him 'Why do you plow and plant with such great excitement but sing sad songs when you are threshing?' and he said 'Well, we (men) are about to hand over the teff to women.'"

Female: "Yes. Once the teff is home, it is our (decision)."

— Participants, mixed-gender FGD

Decision-making on Teff Best Practice Adoption

Next, we focus specifically on decisions pertaining to best practice adoption for teff farming. We examine each phase of the teff growing season individually and highlight who is responsible for decisions and any challenges faced in the decision-making process.

Table 4: Summary of responsible decision-maker (most common response and percentage)

	According to **Men**	According to **Women**
Land Preparation	**Man decides** 91%	**Man decides** 78%
Sowing	**Man decides** 87%	**Man decides** 64%
Fertilizer Application	**Man decides** 75%	**Man decides** 53%
Weeding	**Man decides** 60%	**Joint decision** 59%
Pest & Disease Mgmt.	**Man decides** 86%	**Man decides** 56%
Harvesting	**Man decides** 77%	**Joint decision** 54%
Threshing	**Man decides** 62%	**Joint decision** 49%
Post-Harvest Mgmt.	**Joint decision** 61%	**Joint decision** 73%
Selling	**Joint decision** 74%	**Joint decision** 77%

Women and men generally agree on who makes the decision for 6 of the 9 teff activities. On 3 activities (weeding, harvesting, threshing), the most common response for women differs from that of men, with women seeing decisions being made jointly, and men seeing themselves as making the decisions alone. Overall, men are significantly more likely to report themselves as

the sole decision-makers, while women perceive the decision-making process as a joint one that occurs after discussion within the household. Decisions that have a significant financial impact on the household, such as on selling versus storing teff for later consumption, are reported by both genders as joint. Other activities where women are highly involved, such as weeding or threshing, are also reported as areas of joint decision-making by women, but not by men. In the case of harvesting and threshing, women can exert control over the timing of harvesting due to the gendered social norm of providing food and drinks for hired laborers. These dynamics are explored in more detail below for each agricultural activity.

The decision-making process often takes the form of a discussion between spouses, who may also involve other household members or people outside of the household, such as friends, neighbors or DAs. Our data shows that men are significantly more likely to discuss decisions around teff activities with other people within and outside the household, while women mostly discuss with their husbands/other male respondents in the household. This pattern holds for all teff activities, from land preparation to harvesting. A possible explanation for this is that men are in charge of hiring or trading labor with others in the community, for activities such as weeding, threshing or harvesting. Coordination with them is therefore essential. Another explanation is that while men consult others for information to inform their decision, women consult with their husbands as part of the decision-making process itself (i.e., to not only make the decision but to obtain the permission to move the decision forward, as they cannot make the decision themselves). Women are also less likely to consult with others outside the home because of lack of access to information sources (and potentially social norms regarding who they can consult). The only exception is teff storage, where a similar share of both men and women report primarily discussing with each other.

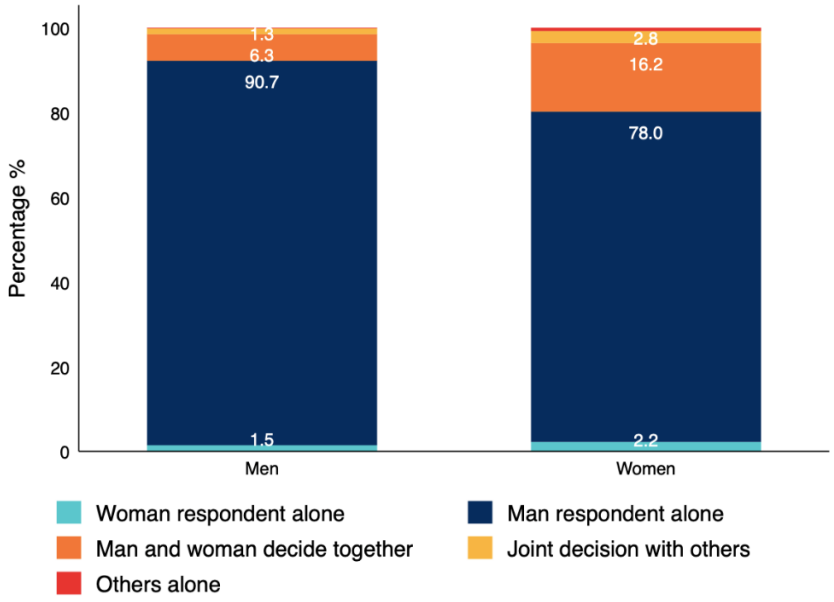
Below, we outline in detail the decision-making for each of these activities according to women and men, as well as highlight who was involved in the discussions around the activity.

Land Preparation

Participants report that men are usually the sole decision makers regarding how to till the land for teff. More women than men report that decisions on how to till the land are made jointly among couples. Men are significantly more likely to report having access to information that will help in making decisions on how to till the land for teff compared to women.

Participants reported that while men are responsible, wives make suggestions and have a stake in deciding where to plant teff, and how much of the plot should be covered by teff. A male farmer also added, “Women do not decide when and how to plow the land. On the other hand, women actively participate in choosing which plot of land, and what size of land could be covered by teff. Since they know more about the amount of crop needed for consumption, they have more stakes in this regard.” Women are believed to have less knowledge about plowing, which explains their lower involvement in decision making, as a female farmer noted, “A wife will not comment on plowing. Why would she? She knows nothing about it. It is the man who knows if the soil has received enough rain or not. We don’t know these things.”

Figure 14: Person Responsible for Decision Making - Teff Land Preparation



Husband: "*She will not interfere with plowing. Her advice is actually useful. But in our culture we live as a man and a woman [different roles]. I plow the land. Had I not done my job well, she would have said 'oh but Mr. X is doing this and Mr. Y has done this…' But I focus and do my job well and so she can't interfere with that. And even if she doesn't do the plowing, she does comment.*"

Wife: "*If I give him some advice, he says to me 'a woman should not interfere with plowing. You should be concerned with your own job, your kitchen work. Regarding plowing, even if I do it right or I make mistakes, I know better.' So, I tell him that he knows better about that and I will leave it to him*.

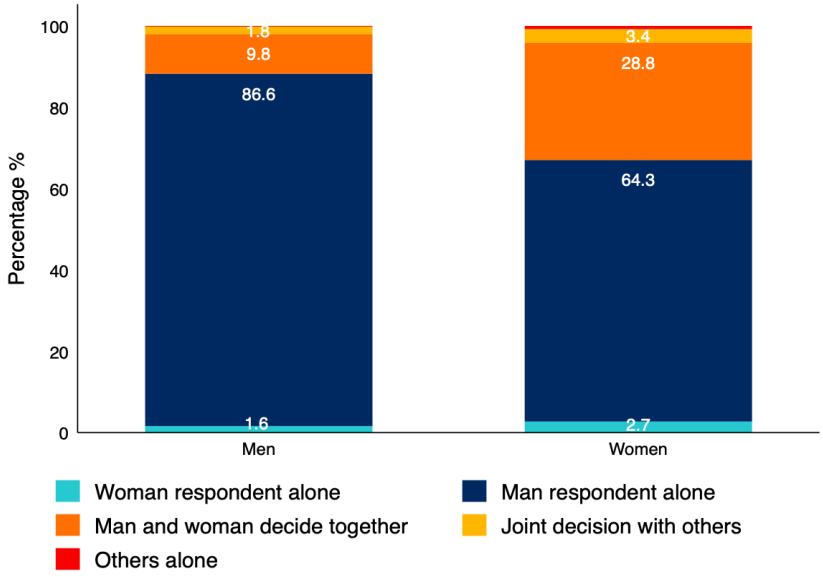
— IDI with couple

Sowing

In the majority of households, men are the sole decision makers on how teff is sown. About 75% of respondents assign the decision on how to sow (in rows or broadcasting) solely to men, with more men (87%) than women (64%) reporting this.

Our qualitative insights, however, paint a more mixed picture on sowing, showing women have some involvement. Many respondents stated that women are involved in decision making, as sowing is a labor-intensive activity requiring their involvement, as noted by a male farmer, "The women are actively engaging in decision making activities, since sowing assignments need their participation. The women have to supply the teff seed, and sometimes support their husband by facilitating things around." In some other cases, women may be responsible for managing seeds for planting, or choosing where to plant teff. Women's involvement in these decisions is important, as sowing practices (broadcasting or sowing in rows) have significant labor implications for weeding activities later in the season, which will often be carried out by women and children.

Figure 15: Person Responsible for Decision Making - Teff Sowing



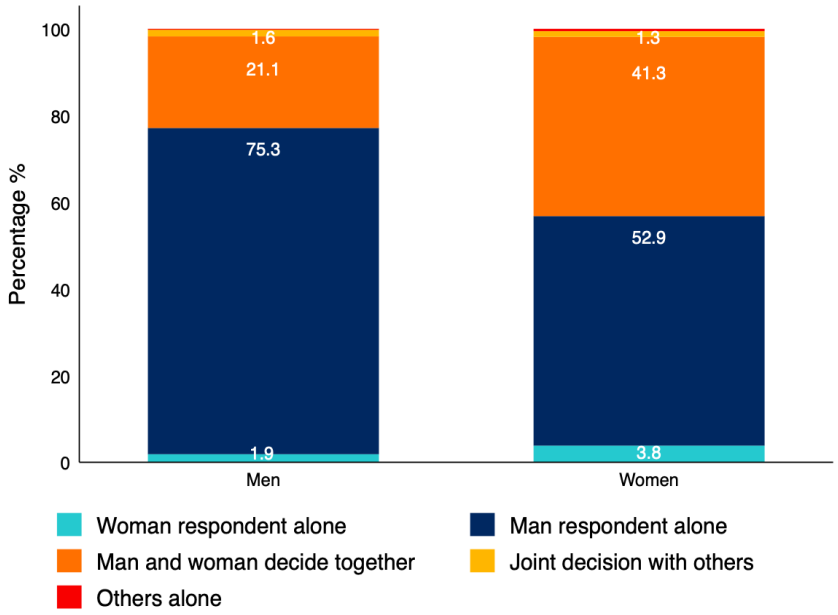
Fertilizer Application

Men are reported to be the sole decision makers regarding fertilizing teff. However, nearly all women (92%) and men (99%) gave their input into some or most of the decisions on the application of fertilizer for teff.

Women are commonly involved in decision-making on fertilizer particularly at the sowing stage and when purchasing fertilizer. A male farmer noted that since fertilizer is a significant expense, the quantity purchased requires the agreement of both spouses, noting that "[fertilizer] needs to have discussion and understanding with the women about the quantity we should buy since it is related to selling crops and other assets." In terms of fertilizer application, spouses discuss how much fertilizer to use and where to apply it on the plot. One DA noted that, "women have started to question the amount of fertilizer used on each plot of teff, as low yields could be due to a low amount of fertilizer used. Women participate and make serious discussions and decide about the amount of fertilizer to be used, type of crop and cattle to be sold to buy fertilizer."

Purchasing fertilizer is one of the most important household expenses during the agricultural year, and something that will be covered from the income resulting from selling the teff harvest. Therefore, as farmers report fertilizer becoming increasingly expensive, this purchase decision is likely to affect the household's finances as a whole, and would therefore require the woman's consent, or at least participation in discussion.

Figure 16: Person Responsible for Decision Making - Teff Fertilizing



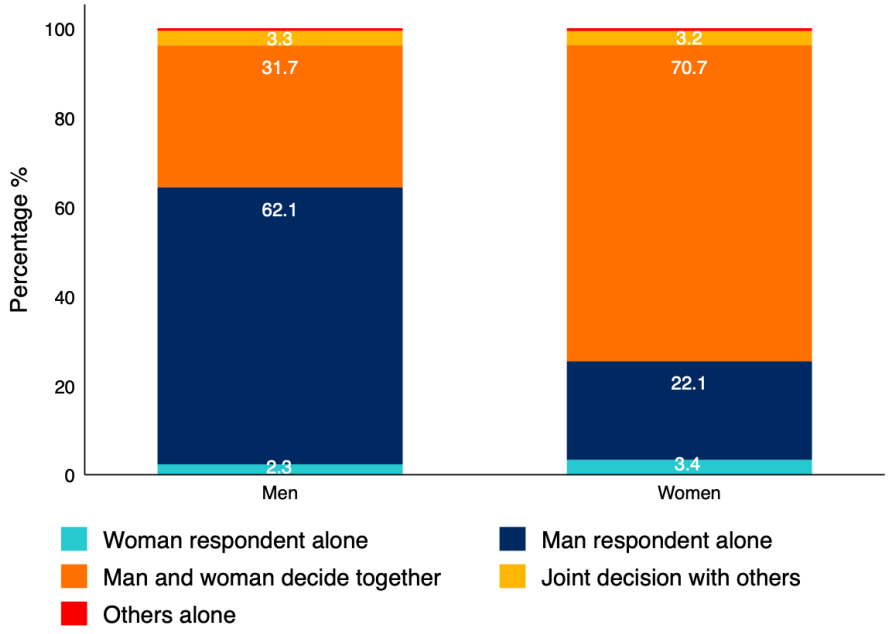
Weeding Practices

Most men (60%) report that they are sole decision makers on weeding, while most women (59%) report that decisions are made jointly among couples. There are similar differences with respect to decisions on weeding by hand and which plots to weed. Women are most involved in manual weeding, and are often the ones actively working on the field, controlling how weeding will be carried out, which may also explain why they are significantly more likely to report joint decision-making. Almost all women (97%) and all men (100%) gave their input into some or most of the decisions on weeding for teff.

Our qualitative data suggests that decision-making on weeding does involve women's participation. The choice of weeding method is typically discussed within the household, as it has important labor implications. A male farmer explained that, "the women participate in the decision making process because women are more involved in weeding activities, not only for teff but also for other crops. There is discussion between family members which method we could use, like manually or using chemicals. Sometimes we use manual wedding if we have time, whereas we use chemical if the weed is more seriously affecting the crop." Women's influence on the choice of weeding methods was also described in detail during an interview with a DA:

> *"Once, I remember looking at the farm of a man who is also a businessman. His teff plant was so bad that it looked like it was burned. I asked why it was like that and they told me he had sprayed chemicals and that was the reason. Then, I was giving training at church and I mentioned his name and told the farmers to look at his teff field to see how he had ruined his teff by spraying chemicals. His wife was there listening to what I was saying. As she got back home, she argued with him and made sure that the teff field was weeded by hand right away. [Laughter] She didn't like that their family was mentioned at church and she pushed him to do weeding by hand. So, weeding work is one that women are more involved in."*
>
> **— KII with DA**

Figure 17: Person Responsible for Decision Making - Hand Weeding Frequency



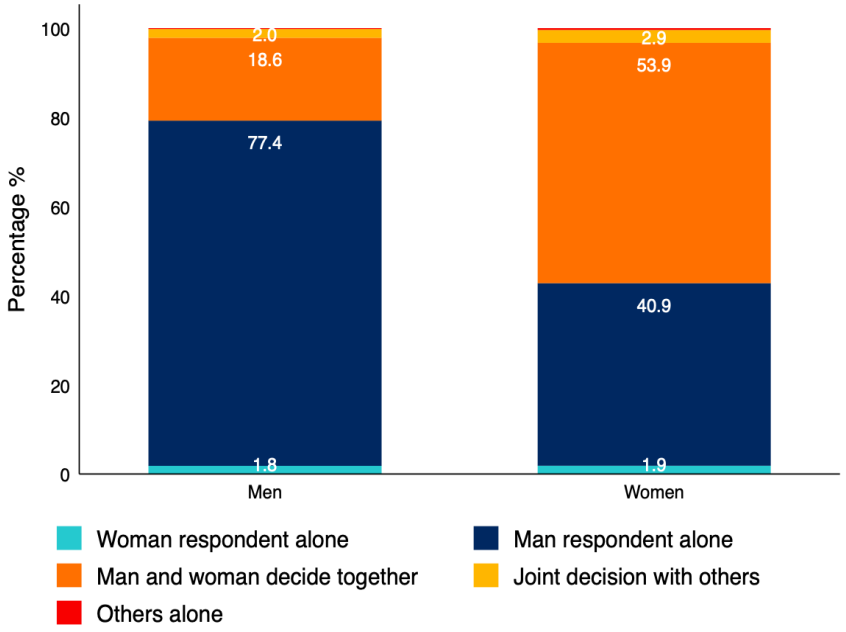
Pest & Disease Management

Participants are significantly more likely to report that men make decisions on pest management alone. The majority of men (86%) report that men make decisions on pest management alone. Women are more likely to report that decisions are made jointly between couple.

Harvesting

Most men (77%) report that they are the sole decision makers, while more than half of women (54%) report that decisions are made jointly among couples. Almost all of the respondents report feeling empowered to make decisions regarding harvesting of teff and also reported that they gave their input into some or most of the decisions around harvesting. Men are significantly more likely to have access to information that will help in making decisions on harvesting compared to women — almost all men (90%) and many women (72%) have medium to high access to information on harvesting.

Figure 18: Person Responsible for Decision Making - Teff Harvesting



Threshing

62% of men and 45% of women report men are the sole decision makers on threshing. All men and almost all women (96%) reported giving their input into some or most decisions around threshing. Half of women (49%) and one-third of men (32%) report that decisions on threshing are made jointly with the other respondent.

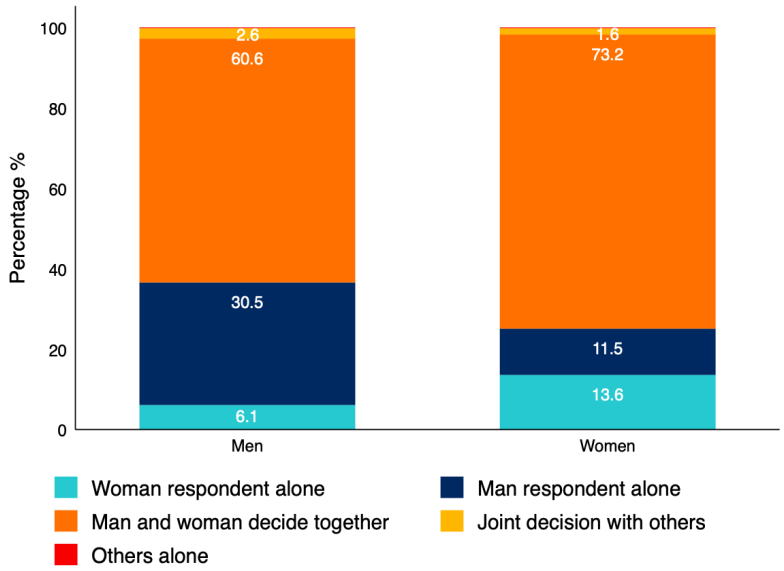
For both harvesting and threshing, our qualitative insights show that women are involved in decision-making due to their responsibility to prepare food and drinks for laborers. Whether it's hiring labor or trading labor and cattle with neighbors through the wonfel system, gendered social norms state that the work cannot commence unless the woman has prepared food and drinks for everyone involved. Women's participation is therefore crucial for both activities, as one female farmer explained, "The women will suggest harvesting late if they haven't prepared enough food and drinks. If the husband refuses to wait, it will not be possible for him to call people for help as it is mandatory to serve food for people who help with harvesting and threshing. Therefore, women have more say when it comes to deciding when to start harvesting." A male farmer agreed, saying, "for harvesting and threshing, it is actually the women who are in control. For example, she has to collect the harvest… also, she has to say 'I have the food and drinks ready. Now you can go look for people to help'. In our culture, it is important to serve food and drinks (Tella) for trading labor. And this is what she has to take care of." Another male farmer agreed with this view: "What can I do if the food and drink is not ready? There is nothing I can do (except wait). I have to wait for her. I can call my neighbors to help with harvesting and threshing only when she is ready." Therefore, it appears that women's engagement in the decision stems from a gendered social norm, not from her input regarding production.

Post-Harvest Management and Storage

Post-harvest management and storage is an area where women are most involved in decisions, as compared to other teff farming activities. 73% of women and 61% of men report that decisions are made jointly. As a male farmer stated, "Storing and selling are the two serious activities that need serious attention of both the women and men. Both discuss and decide in this

case." Another male farmer agreed, "The women, including my wife, actively participate in the decision-making process of storing and selling activities of teff. Basically, storing crops at home is the responsibility of the women, and as a result sometimes they are making more decisions in this regard. Similarly, selling teff needs the agreement of both me and my wife. First, we have to agree how much to sell, and how much of the crop should be stored for consumption." The decisions around storage and selling teff are inextricably linked in many households.

Figure 19: Person Responsible for Decision Making - Teff Post-Harvest Management



Selling

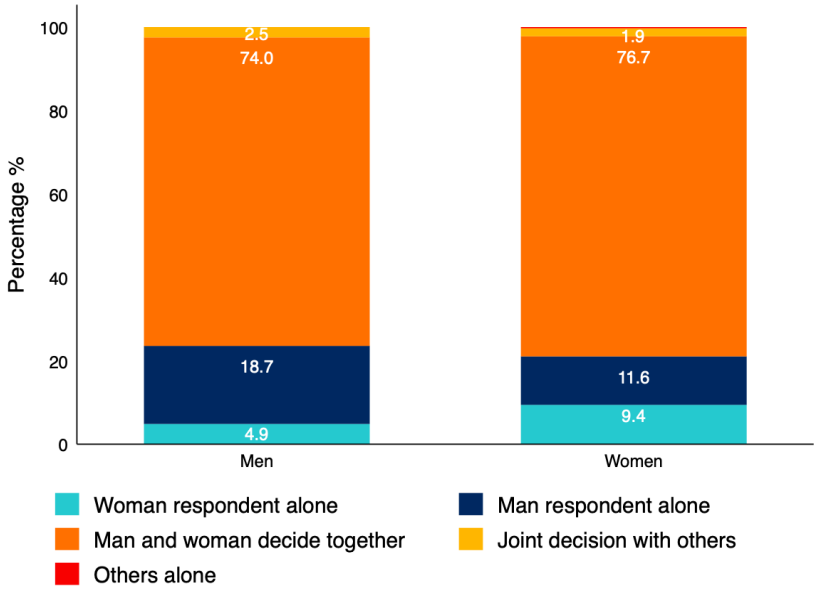
In the majority of households, men and women make decisions together regarding how much teff to sell. Most women (77%) and men (74%) agree that decisions are made jointly between couples.

Generally the men lead the sale of large amounts of teff and women have more power over small amounts of teff (used for sale and consumption). As a male farmer explained, "I personally give direction immediately right after threshing teff. I allocate the crops for consumption, and for selling. I initially manage the amount of teff to be sold to buy fertilizer, teff to be sold to buy clothes for the children, and other expenses. But my wife is responsible for managing the teff allocated for consumption and teff allocated for selling to buy daily consumption materials." Once the teff is allocated for storage, women control that teff, something respondents of both genders agree on. A woman farmer explained that, "once the men have brought the teff home, they don't know how much is left after a while…or whether or not we have finished the teff stored. So it is us women who control that." A male farmer agreed, stating that "Once the crop is allocated for consumption, the women are fully responsible to manage and decide whatever she wants to do. I do not ask her about whatever happens to it, she may sell it, or make it all to be consumed or anything else."

These findings may explain why there was disagreement in our quantitative data when households were asked who completed the transaction to sell the teff. About half (56%) of men reported that they sold the teff alone, something only 17% of women agree with. More women (41%) than men (25%) reported that they complete transactions to sell teff jointly as a couple. This can be explained by the fact that women may accompany men to the market to sell teff, or that they conduct their separate sales from the smaller quantities of teff reserved for storage.

Although the amounts sold may differ and/or be sold on different occasions/at different time points, the perception may still arise on women's side that selling teff is something the couple does together, since the harvest is perceived to belong to the household as a whole.

Figure 20: Person Responsible for Decision Making - Selling Teff



RQ3: Links to SAA's extension program

Given the findings in this report, by what mechanism can SAA influence household decision-making and BP adoption? This section summarizes the evidence from the report pertaining to factors that are within SAA's control, and responds to the third research question:

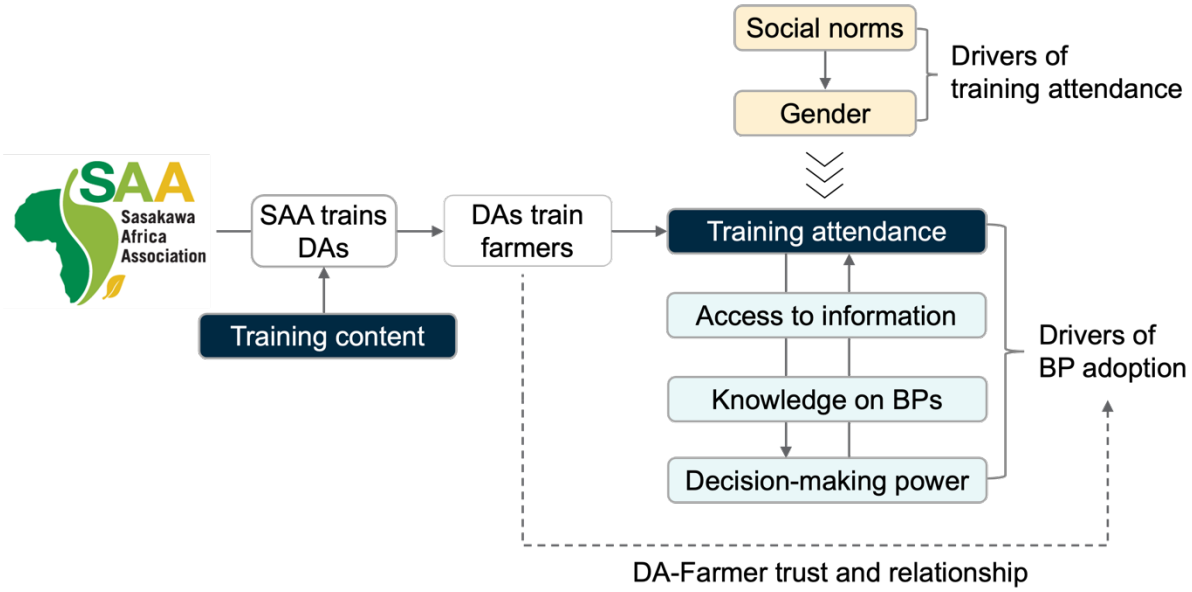
How has SAA's extension intervention influenced teff farming households' decision-making on the adoption of BPs?

While we are not able to make causal claims on the links between SAA and specific household decisions, we can provide evidence of associations between training attendance, decision-making power, access to information, and best practice adoption, so that SAA may act on these rich findings.

SAA's link to decision-making on BP adoption

SAA trains government DAs, who then cascade trainings to farmers on best practices using community demonstration plots (CDPs). Therefore, training content and training attendance are the primary links between SAA and household decision-making. In this section we have identified numerous associations between training attendance and other gender-specific factors, and **Figure 21** illustrates these mechanisms graphically.

Figure 21: SAA's Mechanism for influencing decision-making on BP adoption



Numerous drivers of BP adoption were identified in this study – from the number of household members, to income, to the level of access to information, or level of attendance to training. However, most of these factors are outside of SAA's control. Training content and training attendance are the two factors partly within SAA's control that could influence household decision-making and BP adoption. This section examines training attendance and how it is associated with gender-specific outcomes. Using these findings, we hypothesize how SAA's program may influence household decision-making. In the Recommendations, we highlight some training content that may also influence decision-making.

Training attendance

Training attendance represents the primary mechanism for SAA to influence decision-making on best practice adoption. SAA trains government DAs, who then train farmers. Farmers are recruited into the training by DAs in mixed-gender groups of 15-25. Each group is associated with a CDP and a host farmer (either a man or a woman). The DA is responsible for identifying the host farmer, putting the groups together, and for mobilizing the farmers when the trainings occur.

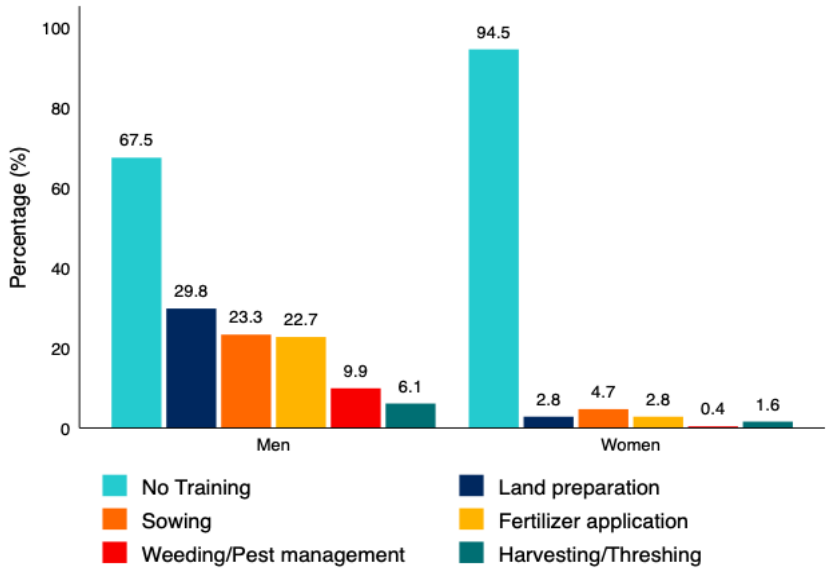
Therefore, attendance to training sessions and access to information provided in those sessions are the direct link between SAA's program and household decision-making on best practices. Our surveys asked men and women about their attendance to SAA-supported government extension training sessions for specific best practices. In the literature, access to extension services has been identified as a key driver for best practice adoption in Ethiopia[76]. We use training attendance as a proxy for access to extension.

In this section we first report findings on training attendance for farmers in our sample. We then establish the link between SAA programming and household decision-making through training attendance and explore any evidence that training attendance has influenced decision-making in households.

Characteristics of Training Attendees

More than half of the farmers (54%) have attended some teff training in their lives, but this is highly skewed towards men. Overall, 78% of the men have attended at least one teff training, while only 30% of the women have attended any training. Of the farmers who have attended training in the past, most of them report attending before this season. About 22% of farmers have attended a teff training in this season (August 2021 - February 2022, Hamle 2013 - Yekatit 2014). The remaining 32% of farmers attended teff training before this year. A small portion (2%) of farmers reported that their first teff training ever occurred during this season. Farmers reported the most attended trainings were (in descending order): i) land preparation, ii) sowing and fertilizer application, iii) weeding, and iv) harvesting and threshing.

Figure 22: Participation in training this meher season (n = 504)



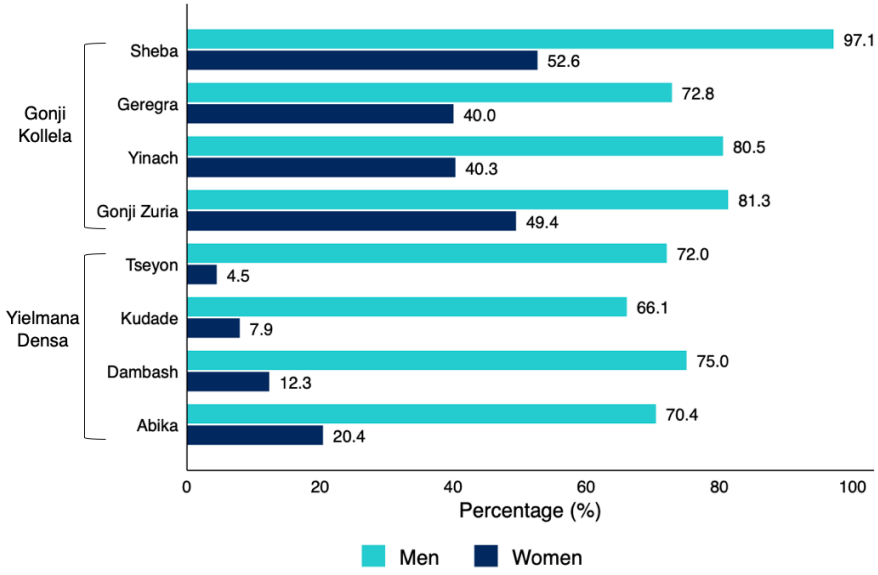
[76] Feyisa, B. (2020).

Women who are registered[77] with the DA have a significantly higher all-time attendance rate (53%) than unregistered women (24%). The average attendance rate for men who are registered is 77.7% and is not significantly different from the one of unregistered men (77.0%).

Training Attendance by Location

Yielmana Densa woreda has lower attendance rates than Gonji Kollela, driven by the extremely low participation of women. In Gonji Kollela woreda, 64% of farmers (83% of men and 46% of women) had attended a teff training in their lives, while this figure is 41% in Yielmana Densa (71% of men and 11% of women). At the kebele level, the highest attendance is reported in Sheba (75%), Gonji Zuria (65%) and Yinach (60%) kebeles in Gonji Kollela, which have significantly higher than average attendance ($p = 0.01$). The lower attendance rates in Yielmana Densa woreda are driven by Tseyon (38%) and Kudade (37%) kebeles, which have below average attendance.[78]

Figure 23: Attendance to some teff training (ever in lifetime) by gender and kebele (n=1,110)



Perceived usefulness of training

Farmers – both women and men – overwhelmingly find trainings to be useful, with an average score of 3.4 out of 4, where 4 is very useful and 0 is not useful. In Round 1 of data collection, 178 farmers (165 men and 13 women) reported to have participated in land preparation training in the current meher season and 99% of both men and women found the training useful or very useful. Similarly, 190 farmers (171 men and 19 women) participated in a sowing training in the current meher season and 94% (93% of men and 100% of women) found the training useful or very useful. Almost all (99%) of the 189 farmers (169 men and 20 women) who attended fertilizer application training found it useful or very useful. Between Round 1 and Round 2 of data collection (August 2021 - October 2021) 26 farmers (25 men and 1 woman) reported attending a training on pest and disease management and 31 (29 men and 2 women) attended a training on

[77] Each of the 550 households has one registered farmer that was sampled for the study, which is a man in 81% of cases, while in 19% of households a woman is the registered farmer.
[78] We performed statistical tests between the attendance rate for each kebele and the average attendance rate of the whole sample, controlling for gender, age, education, DA, gender of DA, household wealth, farm size, number of household members and sampling design.

weeding, and all farmers found the training useful or very useful. In Round 3, all of the 14 participants (11 men and 3 women) who had received training on harvesting, threshing and post-harvest practices since Round 2 of data collection (October 2021 - February 2022) found the training useful or very useful. This is very positive evidence for SAA in that trainings are having an impact.

Knowledge on Teff Best Practices

Access to knowledge on best practices through extension services has been identified in the literature as a driver of best practice adoption in Ethiopia.[79]

Our study shows a strong association between training attendance and knowledge of best practices, confirming the literature. In our study, the knowledge and adoption of teff farming best practices were assessed in three rounds of surveys through the 2021-2022 (2013-2014) meher season. Round 1 assessed best practices for land preparation and sowing. Round 2 focused on fertilizer application, weeding, and pest and disease management practices. Finally, Round 3 looked at harvesting, threshing and storage practices.

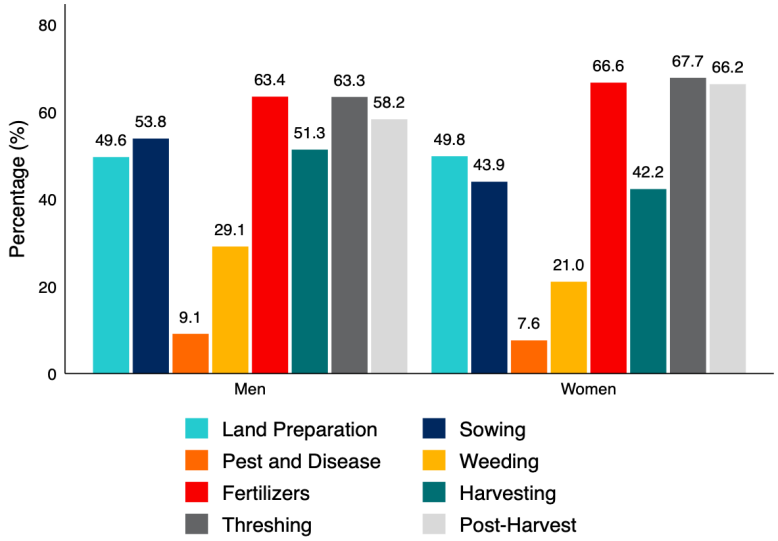
Note: **Appendix 1** *provides the complete details on the best practices and their adoption criteria.*

On average, farmers replied correctly to 13 of the 27 (48%) knowledge questions. The topics covered land preparation, sowing, fertilizer application, weeding, pest & disease control, harvesting, threshing and post-harvest management. The most knowledgeable farmers provided correct answers on 67% of the questions (18 of 27 questions) while the least knowledgeable farmer provided the correct answer for 26% of the questions (7 of 27 questions).

There are small, but statistically significant, gender differences in terms of knowledge. On average, men replied correctly to 13.0 (48%) knowledge questions, while women knew the correct answer to 12.6 (47%). Men have more knowledge on sowing, weeding, and harvesting best practices, while women have more knowledge on fertilizer and post-harvest management best practices. There are no significant gender differences in knowledge on land preparation or pest and disease management.

Appendix 2 provides full details on women and men's knowledge of the individual best practices.

Figure 24: Knowledge of each best practice area by gender (n = 1,082)



[79] Feyisa, B. (2020).

Gendered Barriers to Training Attendance and Participation

The most direct link from SAA to BP adoption occurs when farmers attend training sessions conducted by DAs who have been trained by SAA. Therefore, understanding what is driving attendance to training is important for SAA. In this section we explore what is driving women and men to attend or not attend training sessions.

Table 5: Drivers of training attendance

(+) Positive association to training attendance
(–) Negative association to training attendance

Gender-specific drivers	Control drivers
(–) Being a woman (+) Being a registered farmer (for women)	(+) Having more land (+) Belonging to social groups

Being a woman is negatively associated with attending training. The results of our analysis show that being a man increases the likelihood of having attended at least one training by 44 percentage points (p = 0.001). Our qualitative data suggests that it is local norms that prevent women from attending teff extension training. As one DA explained:

"There is a long-standing pressure that keeps the women in the house or the kitchen. Having them go outside is not encouraged by the culture… if it is their sons who are working on the farm, it will be their sons who will receive the training, although it will be the women's names that are written on the list as they are the head of the household. It is very unlikely for the women to come to the training."

Participants echoed this sentiment, as revealed in an interview with a couple. The husband explained that, "they want women to attend the training. But we (men) have a problem [with that]. We say to the women 'How can you go to the office while I am staying at home?!' [couple laughs]" The wife added, "I will be asked 'Since when did you become an office woman?'" Furthermore, married women are also not expected to attend training on their own, as a male farmer explained, "[She will not attend] unless she is single. If she is married, she doesn't come to training on her own as if she is the head of the household. A wife of a man will not do that."

Women's domestic responsibilities, such as childcare, food preparation or tending to cattle, are a significant factor in preventing women from attending trainings. In some cases, it is the husband preventing their wife from attending, as a female farmer noted that, "We are invited too, but [the men] ask that we be left at home and they join the meetings." Another female farmer did not say she had been invited, but offered a similar explanation:

"I have not participated in any training…They invite him. In our culture, women are not invited to such meetings. Since the cattle will have to be kept inside if we are to leave and come to the meetings; and since the children are at school, the men will ask 'Let us come to the meetings and let the women remain at home. Let them take care of things at home because the children will also be in school."

This view was echoed by a DA, who stated that "Women have more domestic responsibilities including childcare and other food preparation but are less committed to come outside. Unless we call special meetings for the women only, it is the husband who mostly come to attend the meeting or trainings."

When women do attend training, the perception is often that they participate less in discussions and retain less information. A farmer noted that women are less likely to remember what they learned, given their additional workload at home, stating that "they have so many other responsibilities that they worry about. Even if they come to the training, their minds are at home." A DA explained that men and women, "are different in their ability to grasp the points. Men are quick to receive the information and to apply it. They follow us well. The women are different due to the culture, and because they won't go to the field and practice it themselves."

Even in situations where women do have knowledge on best practices, it is culturally appropriate for them to defer to the men present during training. A DA noted that, "The women may tell you 'It is the men who know about this or that. Not me.' I think that they don't answer questions much because they think society would say 'How does a woman know about this?' So, even if they knew the answer to the question, they just leave it for the man to answer, as a way of showing respect for the man." Given these social norms which limit women's participation, it may be beneficial to conduct women-only extension trainings.

Outside of training, there is also the perception that women share less of the knowledge they gain from the training. Discussions between spouses are common, but women do not necessarily discuss teff farming with other women outside the household.

> Female 1: "Why would another woman need to tell me about planting or other? Why do that while I have my husband to talk to? What would a woman know about it?"
>
> Female 2: "What business is it of my neighbor to talk to me about farming? None! I only talk about it with my husband."
>
> **— Participants, women-only FGD**

Women who are registered with a DA are more likely to attend. Farmers who are registered in DA groups have a likelihood of attendance 13 percentage points higher than unregistered farmers ($p = 0.002$). This effect is driven by registered women, who attend far more often than unregistered women. We don't have clear data on what is driving this relationship, but it could be that by registering, women have met the DA, and through this relationship are more likely to be informed of trainings. The relationship could also run in reverse – women who register with DAs are typically women who are more interested and involved in farming already, so they are already more likely to attend. Future studies could investigate this in more detail.

In terms of control factors: location, having more land, and belonging to a social group are also drivers of attendance. Only 11% of women in Yielmana Densa have ever attended a training in their lives, compared to 46% in Gonji Kollela. Unfortunately, we do not have data to elaborate on why this difference exists. In terms of land size, each additional hectare in farm size increases the likelihood of attendance by 5 percentage points ($p = 0.10$). Furthermore, the likelihood of having attended a training in their lives for farmers who belong to a social group is 17 percentage points higher than farmers who don't belong to any ($p = 0.003$). We do not find any evidence that household composition, distance to major roads, education level, and the gender of DA predict ever having attended teff training.[80]

[80] The model is estimated using a multivariate logistic regression controlling for gender, age, education, kebele, gender of DA, household wealth, farm size, number of household members, participation in social groups, distance to major roads and sampling design.

Training attendance and gender-specific outcomes

Our econometric analysis highlighted numerous associations for either women or men on training attendance and gender-specific outcomes, summarized below.

Attending more training is associated with more knowledge of best practices for both women and men, and more access to information for women[81]**.** We find that women who have attended any teff training this meher season are significantly less likely to report no access to information at all for decisions on teff farming. The more teff training sessions women attend, the higher the reported access to information. This confirms the literature and provides evidence for the efficacy of training in disseminating information and knowledge to farmers. Through this channel, SAA has influence on the household.

Training attendance is a strong predictor of involvement in decision-making. Women who ever attended SAA training are twice as likely to be involved in decisions on teff farming ($p = 0.002$). This hypothesis is further confirmed when we look at each best practice individually, and the decisions associated with them. Using a regression model, and focusing on weeding best practices, where women are heavily involved, we find that women who attend training on weeding are more likely to be involved in decision-making on weeding ($p=0.01$), while women who attended training on fertilizer application are four times more likely to report higher input into decision-making ($p=0.02$). We find similar positive but not significant associations between training attendance on land preparation and sowing, and women's input into decisions in these areas. As the sample size is very small for training on individual best practices, we also check for the impact of ever attending teff training and find a strong association between general training attendance and decision-making power on various best practices for women. Women farmers who ever attended SAA training are 2.5 times more likely than untrained women to have input into decisions on weeding and fertilizer application, twice as likely to have input into decisions on land preparation and harvesting, and 3.4 times more likely to have input into sowing decisions.

Gender of the DA

Another channel through which SAA may impact intra-household decision-making is DA gender; throughout our analysis, we find a positive, but not statistically significant impact of woman DAs on women farmers' access to information, input into decision-making on teff farming and perceptions of self-improvement. We also find that women farmers trained by a woman DA are significantly more confident in their ability to apply best practices. In the section below, we therefore explore farmers' perceptions of male and female DAs in more detail using qualitative data.

In terms of perceptions of male and female DAs, most male and female farmers stated that they have no preference, as long as the DAs are educated and can do their job well. Most farmers saw no difference in either gender's capabilities or qualifications, as one male farmer explained: "They are equal, no difference. The women can do what men do. Both are educated." Having a committed DA who is available for the farmers appears to be the most important criterion. As another (male) DA summarized it, "If you schedule a training and don't come on time, it doesn't matter to them whether you are a male or female DA. What matters is how well you are doing your job."

Some farmers, however, indicated that male DAs may have several advantages over female DAs. Many male farmers indicated that male DAs give better trainings, due to their ability to command respect from the farmers and to deal with difficult situations. As a DA explained, "some women DAs may have some limitations in the way they give trainings. They may have difficulties

[81] Controlling for training attendance throughout the meher season, education level, number of social groups the woman is a part of, gender of the DA, household wealth and sampling design.

speaking up, as they are too shy. Not all people have the same energy". This perception was shared by another male farmer: "They are the same in terms of knowledge. However, if it is the male DA speaking during a training, the trainees will all be quiet and pay attention because he is feared more. If it is the woman DA speaking, not everyone will be quiet. This is how they differ." Dealing with farmers as a woman DA may be a challenging experience, as a male DA explained: "Sometimes, farmers may undermine women DA and not accept what she says. Because they assume that she may not have enough knowledge to do that." Given this at times hostile environment, male DAs are also seen as more resilient: "For instance, farmers sometimes even speak awful words and do not pay attention to the DA's job. The women DAs despair easily and are unable to tackle these challenges", as a male farmer noted.

Male DAs are also perceived to be more experienced, since as men, they were raised to become farmers and are therefore believed to have more agricultural knowledge and experience. This is seen as an advantage, particularly if the DA hails from the same rural community he is serving. A male farmer explained that "For me, a male DA is better, because since he is from the community and might have farming experience in the family, he would be able to give more information and committedly change the sector". Finally, in terms of training content, male DAs are seen as more capable to directly show agricultural practices on demonstration plots, such as land preparation. As another male farmer noted, "men are good in showing different farming activities for the farmer practically, such as plowing, which is motivating for us". Some women farmers also mentioned that women DAs provide information on a more limited range of topics, not all of them pertaining to teff farming. For instance, farmers in our sample recall women DAs teaching them about energy-saving cooking options, terracing, applying herbicide or weeding, but not much additional content regarding teff farming in particular.

One recurring theme male farmers mentioned is that women DAs are limited in their mobility, while men DAs are better placed to perform field and home visits and meet farmers in different villages. This is seen as an issue both due to physical fitness, with male DAs being perceived as stronger, more capable of walking long distances, of working long days and engaging in seasonal field activities, as well as a challenge in terms of personal safety and security, if women DAs have to move from village to village. As a male farmer explained, "Women DAs could not cope and manage their job well. As a DA worker, he or she has to travel long distances, and conduct home-to-home as well as field visits in seasons like planting and harvesting. In this case, women cannot manage walking long distances like men. In addition, DA workers sometimes show activities to the farmers, like digging and plowing, which could be very challenging for the women". This view was echoed by numerous other male farmers, who stated that while women DAs tend to be available at the kebele office, men DAs are better placed to engage in frequent supervision and seasonal field visits. Safety was also frequently mentioned as a reason for women DA's limited mobility. As a male DA explained, the challenge for his female colleagues in the kebele is mobility. "I personally can go anywhere and come back safely without any concern, but the female workers may not feel that way. They do not feel secure to go alone anywhere they want. They even fear dogs when they make home-to-home visits."

Although most farmers express no preference for either gender, some farmers stated they prefer women DAs due to their better communication skills and dedication to their job. As a male farmer explained, "I knew one female DA worker; she was so strong and such a hard worker. She was better than male DA workers. She used to communicate with farmers smoothly, and deliver new ideas and practice wisely". Another male farmer underlined that "women DAs are more committed to their responsibilities, communicate and interact more with farmers, and always stay in their office when they are needed. On the other hand, male DA are mostly negligent and do not communicate with farmers more friendly and professionally." Some women also expressed a preference for female DAs, since they feel more comfortable interacting with them, and more

confident asking questions. A female farmer explained that "when the women DAs train us, we understand better. A female DA is better for us, while the male DA is better suited to train the male farmers…. The female DA encourages us (women) to speak up during meetings. When we attend meetings, for example, none of us dare to speak up. The DAs, both male and female, encourage us to speak up about things that concern us. But it is better for us to talk to the female DA alone (not in a room full of people), since we are not scared to talk to her."

"There were female DAs and they got promoted and left. They were very good …they were heroes! They were as good as the male DAs. I don't know why there are no more of them, I prefer to have a female DA. They are closer to us. We invite them to our homes. If it were a man, we wouldn't do that. We call and ask them how to do some things and they guide us. They tell us not to forget what we learned. They encourage us. Every time we meet with them at some gatherings, they teach us well. It would be better if there were women DAs along with the male ones."

— IDI with female farmer

From discussions with farmers, it becomes clear that women DAs may have a positive impact on women's knowledge of agricultural best practices, as well as on their ability to engage with the training content. However, women DAs are sometimes operating in a difficult environment, which may impede their ability to meaningfully engage with farmers, at least on some practices that are seen as more in line with men's gender roles, such as land preparation or harvesting. While there is no immediate solution to women DAs' limited mobility, SAA can focus on ensuring that women DAs are adequately trained on a broader range of agricultural practices, which they can then share with women farmers.

The existing literature also provides some insights on this topic, relating to trustworthiness and role model effects. A study of female leaders in healthcare in Ethiopia found that women spent more time listening to their female colleagues than their counterpart male colleagues, and some described their efforts towards building a culture of honesty in the health system.[82] While this is in a different field (health), it is possible that this same dynamic is present amongst women working in agriculture as DAs. Studies in both economics and psychology suggest that role models who are similar across multiple dimensions of character and identity improve the reception, acceptance, and internalization of messages.[83] It may be that role model effects are also at play with development agents as well, where women are more receptive to messages delivered by women. Our data appears to support this hypothesis: as detailed in the gender roles section, women trained by a woman DA are significantly more confident in their abilities as a farmer.

SAA's Influence on Decision-Making and Knowledge of Teff BPs

Given the above, there is evidence to suggest that SAA can influence decision-making on best practice adoption by trying to increase attendance to training. A concerted effort is needed to increase participation among women, who are currently underserved by extension training. This final section summarizes the gender-specific associations (previously presented) which provide evidence on SAA's influence on decision-making and knowledge of teff BPs.

1. **Men attend training far more than women, so it is likely that SAA's program impacts more men than women.**

[82] Muktar, S.A., Desta, B.F., Damte, H.D. et al. Exploring the opportunities and challenges of female health leaders in three regional states of Ethiopia: a phenomenological study. BMC Public Health 22, 1471 (2022). https://doi.org/10.1186/s12889-022-13871-w

[83] Abate, Gashaw T.; Bernard, Tanguy; Makhija, Simrin; and Spielman, David J. 2019. Accelerating technical change through video-mediated agricultural extension: Evidence from Ethiopia. IFPRI Discussion Paper 1851. Washington, DC: International Food Policy Research Institute (IFPRI). https://doi.org/10.2499/p15738coll2.133323

2. **There is a clear link between women's training attendance and women's access to information for decision-making on teff.** Women who attend training have more access to information for decision-making, which was identified as one of our main drivers of BP adoption.

3. **There is also a strong link between women's training attendance and decision-making power on teff farming,** particularly on sowing, weeding, fertilizer application, and land preparation**.**

4. **Training attendance is also linked to more knowledge on teff practices for men and women.** Participants who have received teff training answer on average 0.45 more questions on best practices correctly than those who haven't ($p = 0.001$). This effect is driven by men, who answer on average 0.5 more questions correctly when they attend training, while trained women answer 0.4 more questions correctly than untrained women, an effect that is also statistically significant.

Recommendations

Based on the findings of this report, IGNITE has three recommendations for SAA.

1. Empower DAs with strategies to get more women to attend training.

Our study shows that training attendance is a driver of adoption for some BPs (including sowing in rows), and that women attend far less training than men. Our study also shows that access to information is both a driver of best practice adoption, and that women have less access to information than men. Furthermore, our study shows a link between training attendance and decision-making power – for men, in general, and for women, when they attend training for an activity (e.g., weeding, sowing) where they are heavily involved.

Therefore, SAA could consider empowering DAs with strategies to get more women to attend their training, especially on farming roles where women are heavily involved (e.g., sowing in rows, weeding, storage). Some strategies might include:

- **Women-assisted Demonstrations (WADs)** – SAA already supports WADs, which are led by women DAs (but men also attend). SAA could continue and expand its efforts here, as our study and the literature suggest that women are more likely to attend training and are more comfortable participating when a woman is leading.
- **Women-only groups** – SAA might consider making WADs a women-only group, as our study and others[84] suggest that women may be more comfortable participating in this setting. Sociocultural norms in Ethiopia make it difficult for women to participate in mixed sex groups. Our qualitative study found women who were not comfortable speaking about farming in the presence of men, and also found men who would be ashamed if their wives were involved in certain aspects of farming. Creating women-only groups could alleviate some of this social pressure and increase women's access to information.
- **Focus on women DAs** – our research showed that women who train with female DAs have more confidence in themselves as farmers. We also find a positive impact on the adoption of key BPs, such as sowing in the right month or weeding more frequently. However, a woman as a DA is also associated with lower adoption of specific BPs, such as harvesting at the right time or sowing in rows. To increase the quality of information on teff farming for women farmers, SAA could consider providing special training for woman DAs emphasizing the importance of recruiting women into their farmer groups and addressing any knowledge gaps at the DA level. This could include modules on how to be more effective with male farmers and how to deliver training on BPs outside of traditionally "female" activities.
- **Group facilitation training for DAs** – to be aware of gender dynamics within mixed groups and facilitate more effectively to ensure women can speak up and actively participate, and so that men are taught to listen. This requires integrating gender sensitization into the training and utilizing different training methods.
- **Recruiting men as champions for women DAs** – engage male DAs (and potentially other community members) as champions of the work of female DAs, advertising the effectiveness, gains, and successes of female DAs to build trust with communities.
- **Focus on Yielmana Densa** – only 11% of women have ever attended a training in their lives, compared to 46% in Gonji Kollela.

[84] Lecoutere, Els; Spielman, David J.; and Van Campenhout, Bjorn. 2019. Women's empowerment, agricultural extension, and digitalization: Disentangling information and role model effects in rural Uganda. IFPRI Discussion Paper 1889. Washington, DC: International Food Policy Research Institute (IFPRI).

2. Address the sociocultural norms which contribute to gender misconceptions and gender barriers

Socio-cultural norms and gender barriers exist in Ethiopia, which prevent women from taking part in farming, training, and decision-making. For example, there is a common perception that women are not farmers and are not intended to take part in outdoor activities. There is also a common perception that women are weak and not suited for some roles, or that women are not as good at retaining messages learned in training. These ideas are holding women back from attending and participating in training, and contributing to less access to information and less knowledge on best practices.

SAA can conduct a formative assessment to understand these barriers and misconceptions in detail – how they are perpetuated, and how DAs and SAA may be unintentionally encouraging them. For example, it may be the case that male DAs are excluding women from training based on their own personal beliefs on women's roles. The aim of the formative assessment is to identify the main barriers and suggest channels by which they can be mitigated.

Following this formative assessment, SAA can conduct Social Behavior Change Communication (SBCC) training through a Training of Trainers (TOT) with DAs. This would involve creating inclusive Information, Education and Communication (IEC) materials for women and men highlighting the distinct roles that women and men play in teff farming and in the household and addressing common misconceptions. The focus of the SBCC training will be to provide simple, action-oriented messages to promote behavior change for different household members. DAs will be able to use these materials when speaking with farmers. The goal will be enhanced female attendance to training, more favorable perceptions of women as farmers, and participation in decision-making with respect to best practice adoption.

3. Increase access to information – directly address farmer concerns and misconceptions on best practices, especially for women

Many farmers are hesitant to adopt best practices due to lack of access to information, and our study finds that women consistently have less access to information than men. Our study found that it was common for farmers to be misinformed, especially for activities where women are heavily involved – like sowing in rows and weeding, two BPs with extremely low adoption rates. For example, some mistakenly believe that sowing in rows will waste space and not result in higher yields. Others believe sowing in rows will require more fertilizer and seeds (both not true).

However, many farmers also have good reason to hesitate before adopting a best practice. For example, farmers correctly assume it will require more time and labor to implement. This extra upfront effort is often offset by longer-term gains, but the initial cost is real. Similarly, farmers are aware that sowing in rows leads to thicker teff straw, which is used as cattle feed. Cattle do not prefer eating this thicker straw, leaving farmers to have to find alternate cattle feed.

For women specifically, our study hypothesizes that a lack of time for women is a barrier for adoption of certain time-consuming best practices like sowing in rows or weeding by hand or weeding more frequently. Faced with a choice between adopting a best practice and other time-sensitive priorities, women may be choosing other priorities, which might include important roles like childcare or food preparation.

It is likely not the case that farmers are irrational and acting against their own best interests by not adopting a best practice. Our study finds decisions on BP adoption to be highly complex, which is made more difficult by misinformation and lack of access to correct information.

SAA could address these concerns and misconceptions directly in their training and teach DAs how to settle farmer concerns. This could involve specific talking points and rebuttals for common misconceptions and challenges associated with each best practice. Rebuttals and talking points should be gender-sensitive – tailored to the specific misconceptions that women and men have about best practices, and using relevant examples for women and men. In doing this, SAA may be able to increase the quality of information farmers receive, which could lead to more adoption of BPs.

APPENDIX

Appendix 1: Overview of Teff Best Practices and Adoption Criteria

Activity	Best Practice	Criteria for Adoption
Land preparation	**BP1:** Month started preparing land	● Start plowing after harvest in **January** (Tir ጥር) or **February** (Yekatit የካቲት).
	BP2: Frequency of tilling	● Conventional extension system: till **3–5 times.** ● Regenerative agriculture system: till **2–3 times.** Note: The same tillage must have been applied to the entire observed plot.
	BP3: drainage practices for waterlogged plots	● Considered adopted if the household faces water management issues and used **at least 1 or more strategies** to cope (using broad bed maker or traditionally with "dirdaro" (ድርዳሮ) or "shurube" (ሹርቤ)). Note: This best practice was only assessed for households who have experienced waterlogging issues (usually those in Kotcha soils). These practices must have been applied to more than half of the plot.
	Soil type	● **Black (Kotcha) vertisol soil** is optimal, but it has high water holding capacity and requires water management. ● **Loam and sandy-loam soil** types are also suitable for teff. *Note: this was asked about in knowledge questions, but was not included as an observed best practice.*
Sowing	**BP4:** Month teff was sown	● Sow in **July** (Hamle ሐምሌ) or **August** (Nehase ነሐሴ)
	BP5: Use of improved seed varieties	● The following **improved seeds** are suitable for the study area: Magna (ማኛ / DZ-01-196), Kuncho (ቁንጮ / DZ-Cross-387), Dukem (ዱከም / DZ-01-974), Kora (ኮራ / DZ-Cross-438), Dagm (ዳግም / DZ-Cross-438), Negus (ነጉስ / DZ-Cross-429). ● Other varieties of improved seeds for highland/colder areas (i.e., Tsedey, Boset, Smada, Dega, Enatit, Yielmana) can also be considered adopted. Note: Local traditional seeds were not considered improved seeds.
	BP6: Sowing in rows	● **Planting in rows is recommended.** Broadcasting (casting seeds by hand) is not recommended. Note: To be considered adopted, a household must be planting in

		rows for the entire plot, and must be planting seeds at a depth of 1-3 cm.
	BP7: Amount of seeds used per hectare	● Depending on the soil type, **10-15 kg of seed per hectare** of land. Note: This amount is for farmers using the row planting method. Farmers using broadcasting (not considered best practice) use more seeds.
Fertilizer	**BP8:** Fertilizer type	● **NPS and urea** should be applied, **compost** may be used for loamy soils ● **DAP should not be used**
	BP9: Frequency of fertilizer use	● **NPS** application **once per season.** ● **Urea** application **twice per season.**
	BP10: Timing of fertilizer use	● **NPS** application **at the time of sowing** ● **Urea** application first **15-18 days after sowing**, and then again **35-40 days after sowing**.
	Fertilizer amount	Red soil: ● NPS – 100 kg per hectare ● Urea – 37.5 kg per hectare at both applications Black soil: ● NPS – 150 kg per hectare ● Urea – 62.5 kg per hectare at both applications *Note: this was asked about in knowledge questions, but was not included as an observed best practice. These measurements are prone to recall bias and would be difficult to obtain accurate figures.*
Weeding	**BP11:** Weeding Method	● The best way to weed is **by hand**. ● An acceptable alternative is using herbicide.
	BP12: Weeding Frequency	● The plot should be weeded at least **three times** per season.
	BP13: Weeding Timing	● The plot should be weeded for the first time **18-25 days after sowing** (15-18 days after teff has sprouted and the first weeds have emerged).
Pest & Disease Management	**BP14:** Disease management	● Knowledge of common teff diseases: **leaf rust, head smudge, damping off, and zonate eye spot.** Note: respondents were scored as adopting if they knew at least 3 diseases. ● Knowledge of disease control measures: **sowing early in the season, using early-maturing teff varieties, applying fungicide**.

		Note: respondents were scored as adopting if they knew at least 2 control measures.
	BP15: Pest management	● Knowledge of common teff pests: Degeza (Wollo Bush Cricket), Shoot fly, Red teff worm, Black teff beetle, Grasshopper (Fenta). Note: respondents were scored as adopting if they knew at least 3 pests. ● Knowledge of pest control measures: i) Early tilling or tilling soon after harvest (including mention of exposure to sunlight), ii) Deep tilling, iii) Removal of nearby pest hosts (weeds, crop residues, other plants), iv) Practicing crop rotation, v) Use of insecticide, vi) Removing and killing insects by hand. Note: respondents were scored as adopting if they knew at least 4 control measures.
Harvesting	**BP16:** Harvest Method	● Teff harvested by hand with a **sickle or by harvester** (if any)
	BP17: Harvest Timing & Appearance	● Teff harvested by hand with a **sickle or by harvester** (if any) ● Teff harvested about **12 weeks after planting**. Note: The specific time depends on the type of seed. ● Teff harvested when it **appears ready** (when it turns yellow or is dry).
Threshing	Threshing Timing	● Teff threshed **10-30 days after harvesting**. *Note: this was asked about in knowledge questions, but was not included as an observed best practice.*
	BP18: Designated Threshing Area	● Preparation of a **designated area for threshing by one of the following methods:** i) Use plastic sheeting, ii) Use manure/dung to plaster the area, iii) Clean the area, iv) Use a threshing area prepared by someone else.
	BP19: Threshing Method	● Threshed by **animals trampling**, a **threshing machine**, or by beating with **a stick**.
Storage and post-harvest	**BP20:** Storage Method	● After threshing, teff should be stored in **polypropylene or hermetic bags** (PICS, Zero fly, Agroz), **barrels**, **hermetic metal silos**, or **traditional storage** (dibignit, gota). ● Teff should be stored inside the home, as compared to outside.
	Storage Lifetime	● Teff can be stored for an **indefinite amount of years** provided that it is protected against pests and water, and stored properly. *Note: this was asked about in knowledge questions, but was not included as an observed best practice.*

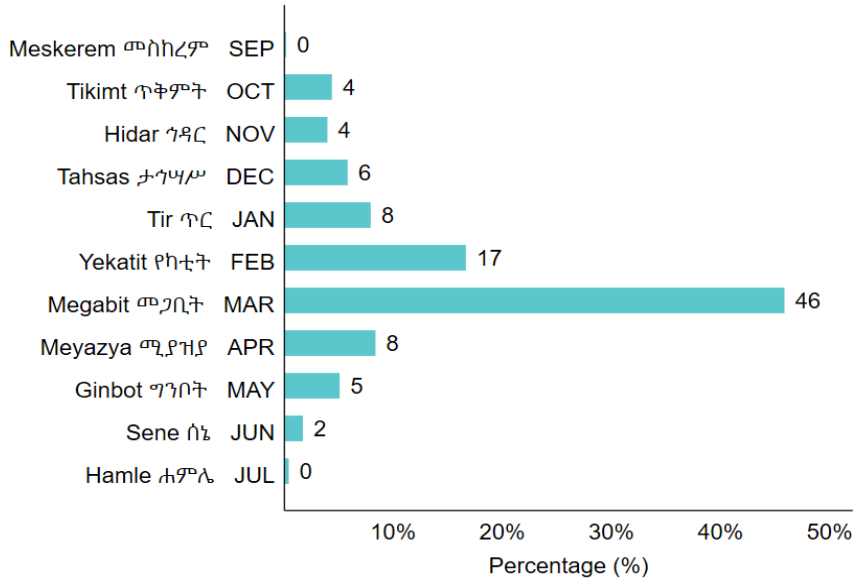
Appendix 2: Details on the adoption of individual best practices

Land Preparation

BP1: Month started preparing land

One-fourth of observed plots started preparing land in January or February, as recommended.[85] Eleven different months were chosen as starting months with March (Megabit መጋቢት) being the most common month to start land preparation. In terms of control drivers of adoption, there was significant variation in adoption by DA and kebele.

Figure 24: Month started preparing land (n = 555)

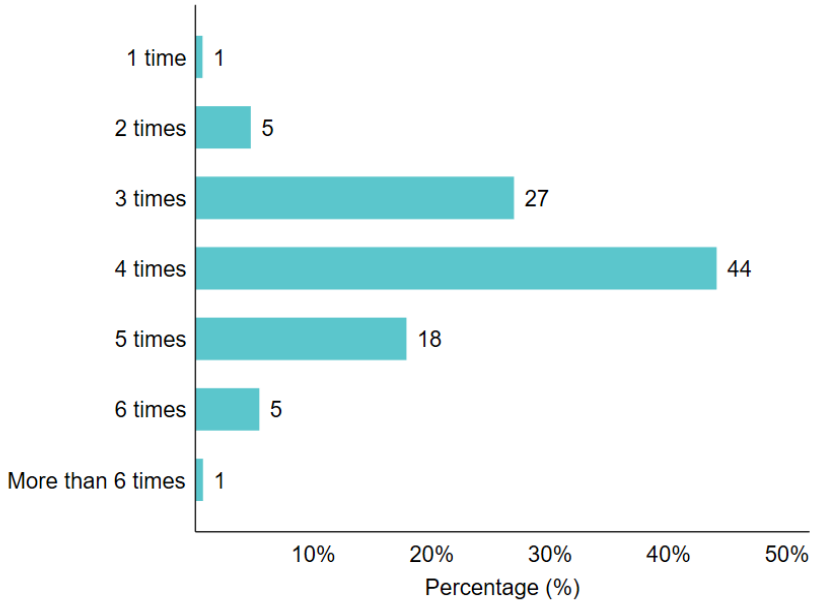


BP2: Frequency of tilling

The vast majority of households (89%) followed the recommendation to till between three and five times, with four times being the most common. Under regenerative agriculture it is recommended to till just two to three times; 32% of observed plots did this.

[85] Under the conventional extension system, it is advised to start plowing right after harvest (in January or February).

Figure 25: Number of times tilled before sowing (n = 555)



BP3: Drainage practices for waterlogged plots

Waterlogging is not a common issue in all woredas — only 81 out of 555 observed plots reported experiencing waterlogging issues on their plot. Out of these, 24% adopt water drainage practices "*dirdaro*" or "*shurube*". Waterlogging was most common in Gonji Kollela, and significantly less common in Yielmana Densa. Some farmers that are impacted by waterlogged soils noted in qualitative work that DAs do not account for their needs in recommendations, and they may not undertake recommendations due to this concern.

Sowing

BP4: Month teff was sown

92% of observed plots followed the recommendation to sow in July (Hamle ሐምሌ) or August (Nehase ነሐሴ). After July, June (Sene ሰኔ) was the second most common choice (7%), although this is one month earlier than advised.

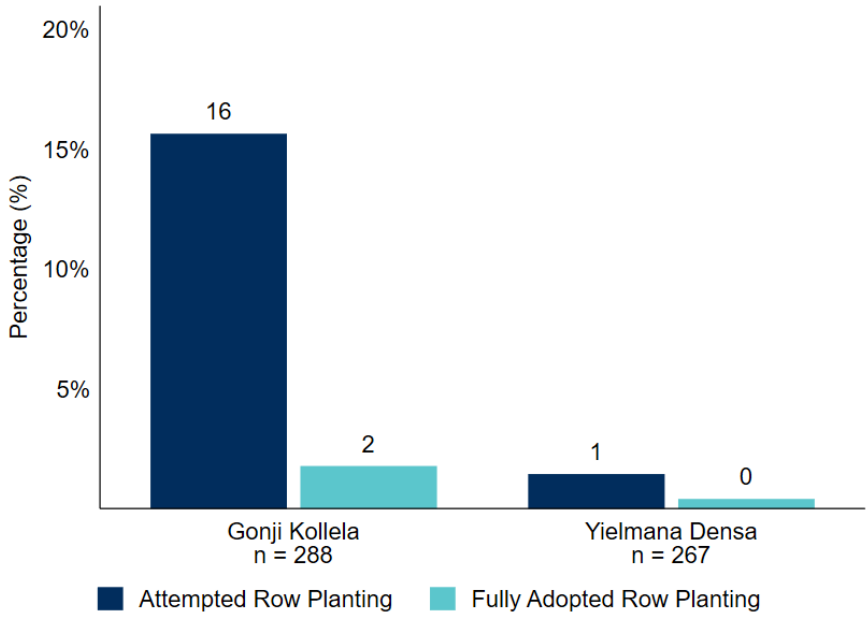
BP5: Use of improved teff seeds

Almost all observed plots in the sample used Kuncho improved seeds, which are advised for the area. Magna, Dukem, Kora, Dagm, and Negus are also suitable for the study area, although they were all very uncommon or never reported.

BP6: Sowing in rows

This practice was the least adopted practice in Round 1. 9% of observed plots attempted row planting and only 1% fully adopted. Full adoption required planting teff in rows for the entire plot (34% of those who attempted did not plant the entire plot), and seeds must also be planted at a depth of 1-3 cm (82% of those who attempted did not). Lack of available labor is the primary reason farmers gave for not planting in rows (65%), followed by thinking the practice would not work (24%).

Figure 26: Row planting: Attempted vs. fully adopted, by woreda



BP7: *Amount of seeds used*

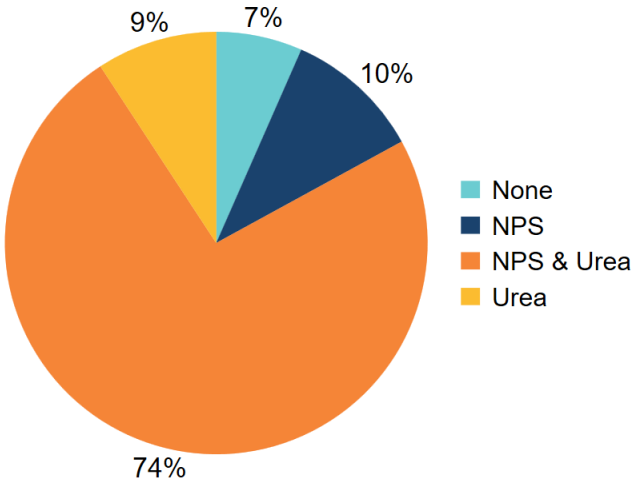
Farmers are using two to three times more seeds than advised, with the average farmer using 35 kilograms per hectare. Depending on the soil type, farmers should use 10-15 kilograms of seed per hectare of land when sowing in rows. Only 6% of observed plots use the advised amount of seeds.

Fertilizer Application

BP8: *Type of fertilizer used*

About three-fourths (74%) of observed plots applied the recommended NPS and Urea; no farm reported applying DAP.

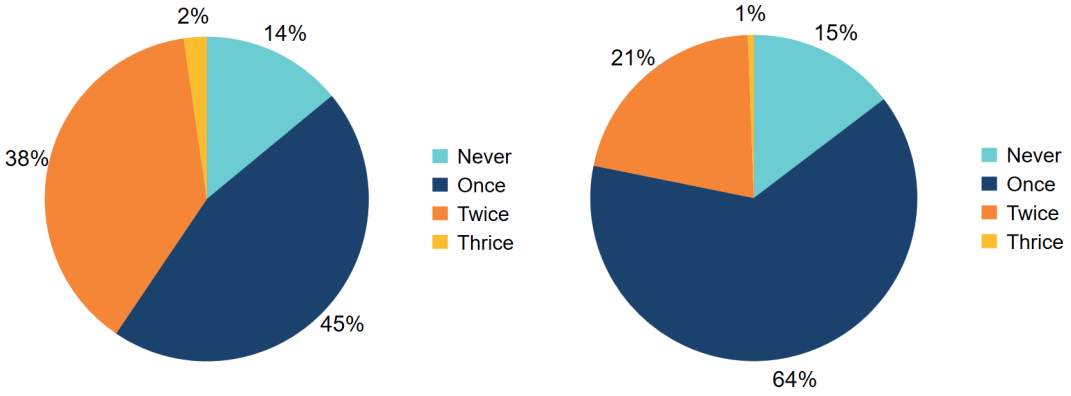
Figure 27: Fertilizer applied on observation plot (n = 555)



BP9: Frequency of fertilizer use

About half (45%) of households applied NPS only once, as recommended, and 21% of households applied urea twice, as recommended. Only 8% of households applied both NPS and urea the advised number of times.

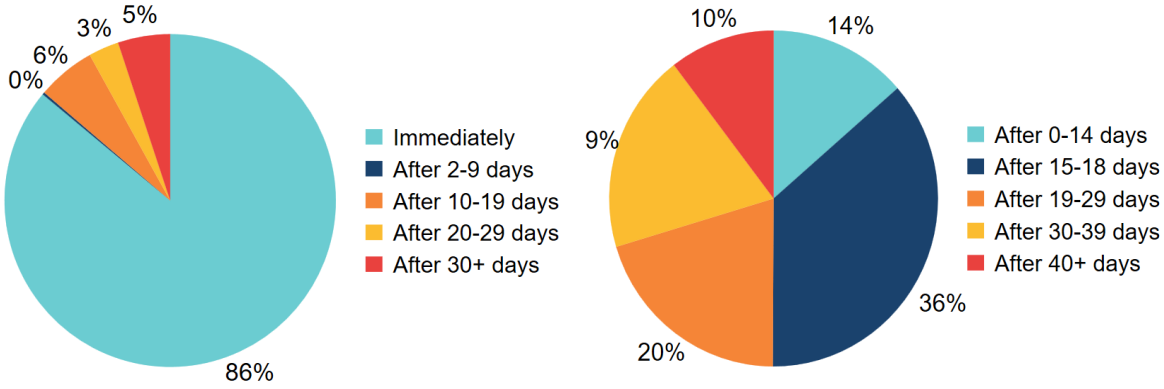
Figure 28: Number of times NPS (left) and urea (right) is applied on observation plot (n = 540)



BP10: Timing of fertilizer use

33% of households applied both NPS and urea the advised number of days after sowing. 86% of households applied NPS immediately after sowing, as recommended, and 36% of households applied urea 15-18 days after sowing for the first time, as recommended.

Figure 29: Timing of application of NPS (left) and Urea (right) fertilizer on observation plot

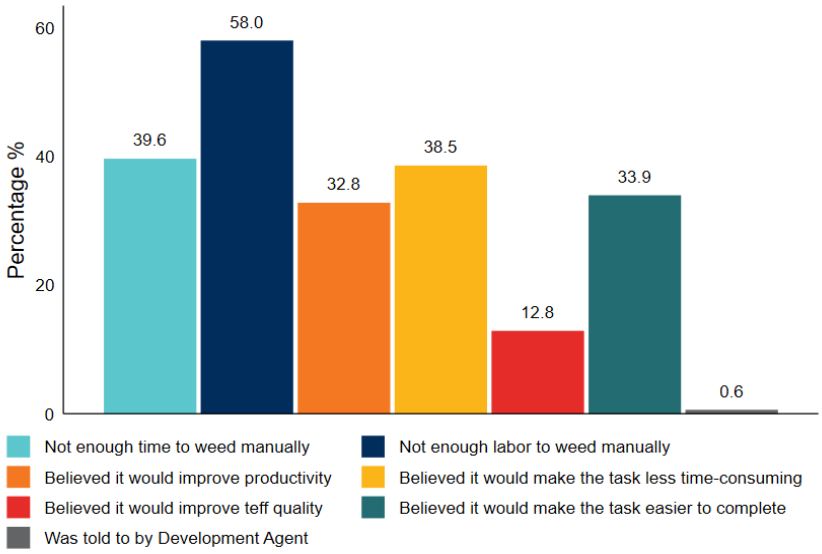


Weeding

BP11: Weeding method used

Farmers are advised to weed by hand and to do so at least three times per season. Only 14 households (2%) report weeding exclusively by hand. The vast majority (92%) combines weeding by hand with the application of herbicides. 37 respondents weed only by applying herbicides, and only 25 households in the sample reported not using herbicide.

Figure 30: Reasons for using herbicides (n = 1,057)



One female farmer in the focus group discussions from Yielmana Densa explains, “we know we get better yield when we weed by hand. If we think we have time, we do weeding by hand as much as we can. And that makes a difference. Other times, we can’t get to it all on time while weeding by hand and so the remaining will be covered with chemicals.”

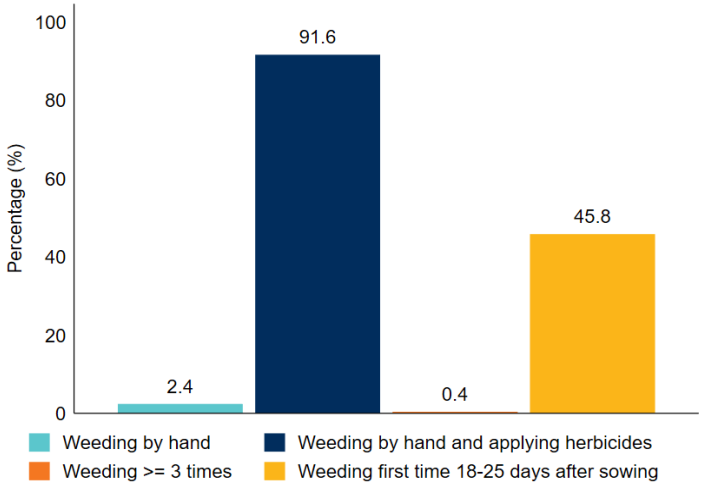
BP12: *Weeding frequency*

In terms of weeding frequency, only two households report weeding thrice per season; most weed only once (80%) or twice (20%).

BP13: *Weeding timing*

Plots should be weeded for the first time 18-25 days after sowing (15-18 days after teff has sprouted and the first weeds have emerged). 46% of households weed for the first time 18-25 days after sowing (by hand or with herbicides).

Figure 31: Percentage of observed plots adopting (n = 555)



Pest & Disease Management

BP14: *Disease management*

47 out of 540 households report having experienced disease problems on their observation plot this season. These include: head smudge (42), leaf rust (4), and zonate eye spot (1). 4% of households took measures against diseases this season. Farmers employ disease management measures both for prevention reasons, and to mitigate diseases. Overall, 21 households report having acted against diseases on their plot this season. Sowing early in the season was the most common measure, employed by 96% (20/21) of households adopting measures.

BP15: *Pest management*

Overall, 27 out of 540 households report having experienced insect pest problems on their teff observation plot this season. These include: red teff worm (23), shoot fly (2), black teff beetle (2), grasshopper/fenta (2), and degeza (1). 7% of households took action against insect pests this season. 72% chose to use early tilling, 65% chose to remove nearby pest hosts, and 53% used deep tilling. 35% of households practice crop rotation. Only 5% used insecticide, while 16% killed insects by hand.

Harvesting

BP16: *Harvest method*

100% of respondents indicated that they have harvested teff this meher season by hand with a sickle, as recommended.

BP17: *Harvest timing*

29% of farms report to have harvested teff when it looked ready (when leaves start turning yellow), which is the recommended best practice, while the majority (71%) harvested in a specific month, particularly in November (89% of those who harvested in a particular month harvested in November (ጎዳር)). When asked for the reasons why they harvested when they did, 96% of households reported the teff was ready for harvest, 32% reported they feared unpredictable rain and 10% reported that they had enough labor available at the time (multiple answers were allowed).

The use of trading labor ("wonfel") for harvesting was commonly reported in the focus groups discussions. Under this system, farming households support their neighbors in harvesting when the time is right, in exchange for support on their own farm.

Threshing

At the time of data collection, 44% of observation plot managers reported having threshed their teff this season. Therefore, the rates of adoption are based on this subsample.

BP18: *Designated threshing area*

The vast majority (99%) of households prepared a designated threshing area, by using manure/dung (97%) and/or by cleaning the area (83%).

BP19: *Threshing method*

100% of plot managers who had threshed teff this season reported to have done so by trampling the teff with oxen. Two respondents used humans to beat the teff with sticks in addition to animals. Both methods are accepted and therefore all applicable households pass this best practice.

Similar to harvesting, it is common for farmers to trade labor ("wonfel") for threshing. One farmer reported that while trading labor has decreased for harvesting, for threshing it has continued, explaining, "In the past, we used to trade labor for weeding and harvesting. Nowadays the only activity we trade labor for is threshing. Farmers are using more hired labor and less trading labor. This is also only because they cannot handle threshing with hired labor as they will need to borrow cattle as well."

Storage

BP20: *Storage method*

81% of plot managers stored teff this meher season, and of those, 100% used one of the recommended storage methods: traditional storage facilities dibignit (53%) and gota (19%), and in bags (39%). Some farmers in Gonji Kollela indicated that they are simply not producing enough teff to store, opting instead to sell it immediately to cover fertilizer costs. One female farmer stated, "I doubt that there is anyone who stores (their teff) these days… We don't store. We don't have enough land (to produce enough for storage). Whether you get 5 or 6 sacks full of teff, you just sell it and use the money to buy fertilizer. We don't have much left to keep at home. It is not profitable as we mostly work on other people's plot of land (to then share the yield)." She added, "thankfully, we produce enough to cover daily expenses. But we don't store…"

Appendix 3: Knowledge of teff best practices, by practice

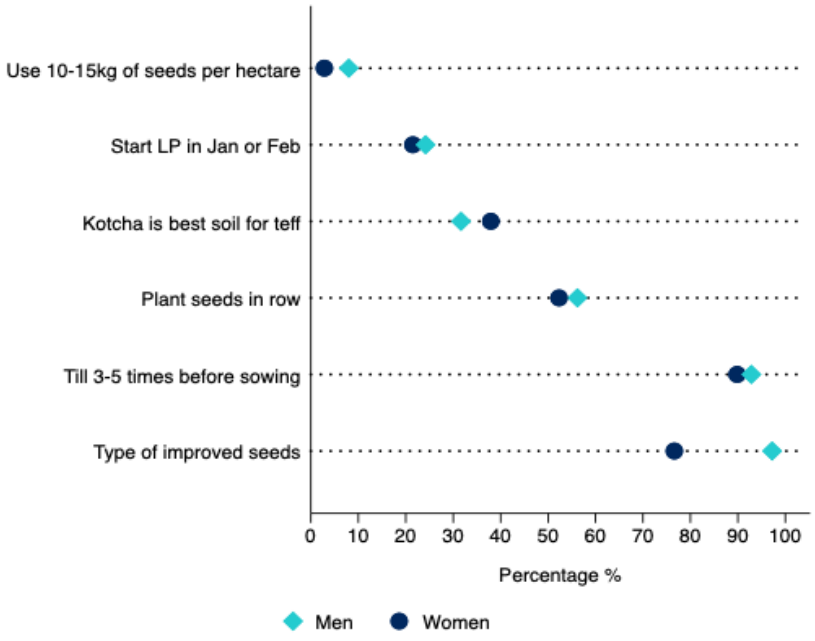
Knowledge of Land Preparation and Sowing

On average, farmers reply correctly to half of the six knowledge questions on land preparation and sowing.[86] The questions asked about the timing of land preparation, seed varieties and quantity, sowing methods, and sowing frequency.

Men have more knowledge than women on the type of improved seeds and kilograms of seeds needed per hectare. From the 6 questions asked about land preparation and sowing best practices, men answer on average 3.1 questions correctly, while women answer 2.8 questions. The difference in knowledge between genders is significant (p = 0.001) and driven by gaps in knowledge on the type of improved seeds to be used — 97% of men reply correctly while only 77% of women specify the correct types of seeds.

We used a multivariate regression model[87] to analyze the drivers of knowledge on land preparation and sowing best practices. The results show that, on average, farmers who participated in some teff training answer 0.2 more questions correctly than those who didn't (p = 0.10). Likewise, men answer 0.2 more questions correctly than women (p = 0.10). There were no differences in knowledge of land preparation and sowing practices by education level, number of household members, or gender of the DA.

Figure 32: Land preparation and sowing knowledge questions, % correct by gender



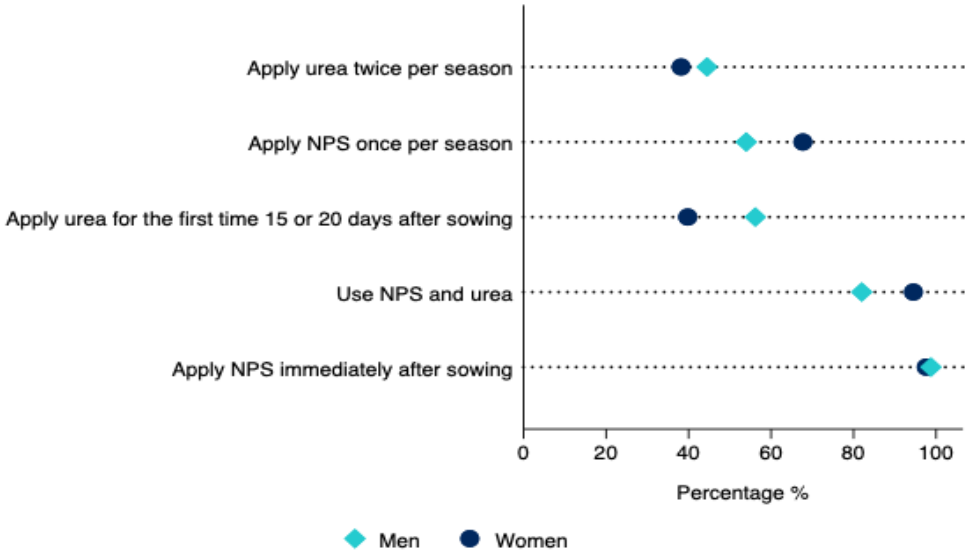
Knowledge of Fertilizer Application

Farmers answer, on average, 3 of the 5 fertilizer best practice questions correctly. Women have more knowledge on fertilizer best practices, answering on average 3.3 questions correctly

[86] We grouped land preparation and sowing best practices because of the small temporal period between the two practices.
[87] Controlling for gender, age, education, kebele, gender of DA, household wealth, farm size, number of household members, attendance to some teff training and sampling design. The results are robust to specifications which included access to information on teff farming, access to information on land preparation and sowing and participation in social groups.

and providing 0.2 more correct answers on fertilizer best practices than men (p= 0.10). Nearly all farmers (98%) are aware of the requirement to apply NPS immediately after sowing and 88% know that NPS and urea are the recommended fertilizers to use. Women are more likely to know the types of fertilizer to be applied and that NPS should be applied only once per season (p = 0.01). On the other hand, men are more likely to know the ideal timing of urea application on teff (p = 0.001).[88]

Figure 33: Fertilizer best practice knowledge questions, % correct by gender (n = 1,082)

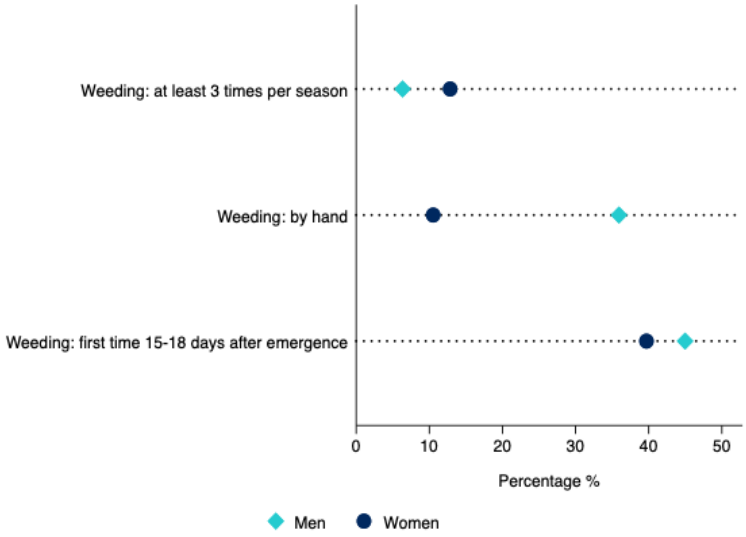


Knowledge of Weeding

On average, farmers have knowledge on one of three weeding best practices. Only three farmers replied to all questions correctly. Men are 25 percentage points more likely than women to report that weeding should be done by hand (p = 0.001), while women are 6.5 percentage points more familiar with the frequency of weeding that is necessary (p = 0.10).[89] While weeding by hand is considered best practice, it also is labor-intensive, and many farmers prefer to use herbicides if possible. More than 90% of the farmers underestimate the frequency of weeding needed, as they only weed one or two times per season. We find that farmers who have participated in some teff training answer on average 0.1 more questions on weeding best practices correctly (p = 0.05). Men answer 0.2 more questions on weeding correctly (p = 0.10).[90]

[88] T-test for knowledge of fertilizer practice and gender.
[89] This was calculated using a t-test for best practice and gender.
[90] Controlling for gender, age, education, kebele, gender of DA, household wealth, farm size, number of household members, attendance to some teff training and sampling design. The result is robust to specifications which included access to information on teff farming, access to information on weeding and participation in social groups.

Figure 34: Weeding best practice knowledge questions, % correct by gender (n = 1,082)



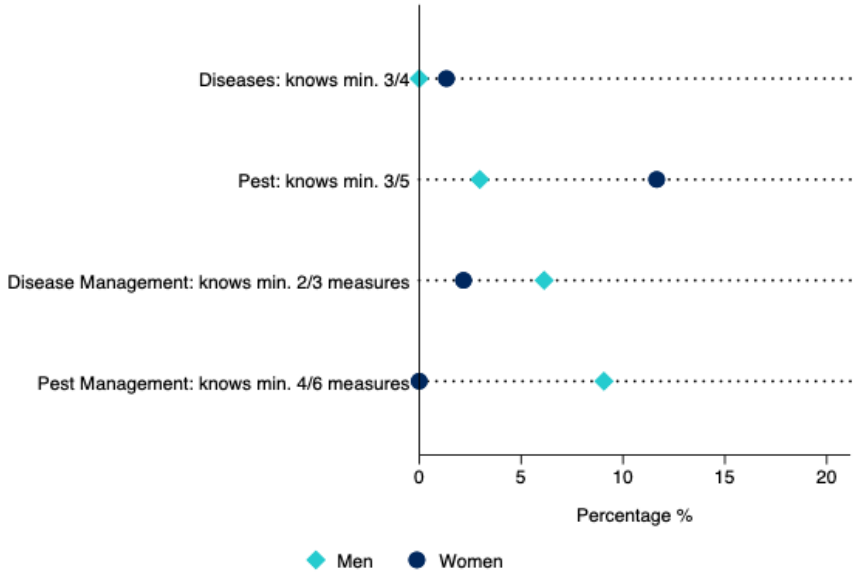
Knowledge of Pest and Disease Management

Farmers have low knowledge of pest and disease management best practices. Approximately 84% of farmers answer none of the four best practice questions correctly. Furthermore, no farmer has complete knowledge of pests, diseases and their management. Only 10 farmers in the sample were able to reply to two questions correctly. Less than half (45%) of farmers were aware of at least one pest, one disease, and one method to mitigate these, while 4% of farmers could not provide an answer to any of the four questions asked.

While women were able to name more diseases and pests (p = 0.05), men were more familiar with the corresponding control measures (p = 0.01).[91] Other predictors of knowledge for pest and disease management best practices include farm size and access to information[92], which both are associated with more knowledge.

[91] This was calculated using a t-test for best practice and gender.
[92] Controlling for gender, age, education, kebele, gender of DA, household wealth, farm size, number of household members, attendance to some teff training and sampling design. The result is robust to specifications which included access to information on teff farming, access to information on teff farming and participation in social groups.

Figure 35: Pest and disease management knowledge questions, by gender (n = 1,082)



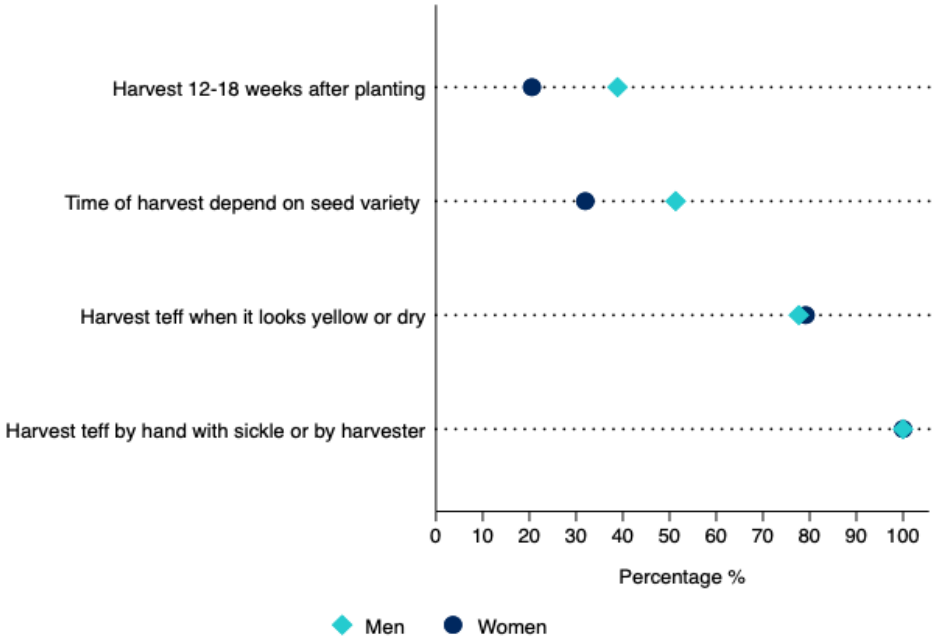
Knowledge of Harvesting

Women and men have equal knowledge on how to harvest teff and on teff appearance at harvesting. Men are significantly more aware than women that different seeds have different maturing times (p = 0.001). As a consequence, they are also more likely to correctly specify the number of weeks needed to wait for harvesting (p = 0.01). On average, teff needs 12 to 18 weeks before being harvested and the specific amount varies according to different varieties of seeds (early, normal, and late maturity). All respondents (100%) know that teff needs to be harvested by hand, with sickle, or by harvester, and 78% of farmers know that teff needs to be yellow or dry when it's ready to be harvested.

On average, men give 0.4 more correct answers on harvest best practices (p = 0.001).[93] Farmers who can access any information on how to harvest teff answer 0.3 more questions on harvest best practices correctly with respect to those who cannot access any harvest information (p = 0.05). A similar effect of lower magnitude is found for farmers who can access information on teff farming in general.

[93] Controlling for gender, age, education, kebele, gender of DA, household wealth, farm size, number of household members, access to information (on teff or on teff harvesting) and sampling design.

Figure 36: Harvesting knowledge questions, % correct by gender (n = 1,110)



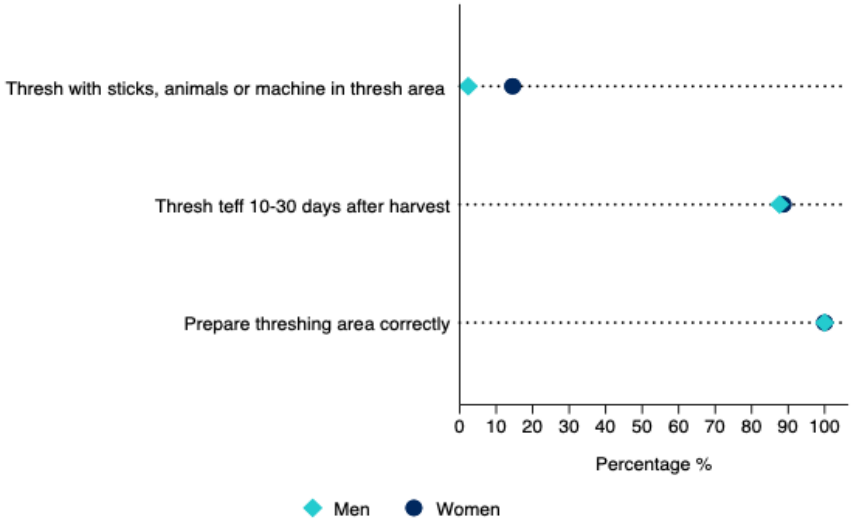
Knowledge of Threshing

The vast majority (82%) of the respondents answer 2 out of 3 threshing best practices correctly. Women have slightly more knowledge on threshing best practices than men. The difference in knowledge between genders is driven by knowledge on the threshing method (p = 0.05). Most participants are aware of threshing methods such as using a stick, using a threshing machine or animals, but only a minority also mentioned that it's necessary to have an appropriate threshing area. Nevertheless, all respondents were able to correctly specify how the threshing area should be prepared when they were asked about it.

On average, farmers who have attended some teff training in their lives answer 0.1 more questions correctly (p = 0.05), while women answer 0.2 more questions correctly (p = 0.01)[94]. Finally, farmers who report access to information on threshing give 0.1 more correct answers than farmers without any access to information on threshing (p = 0.05).

[94] Controlling for gender, age, education, kebele, gender of DA, household wealth, farm size, number of household members, attendance to some teff training, access to threshing information and sampling design.

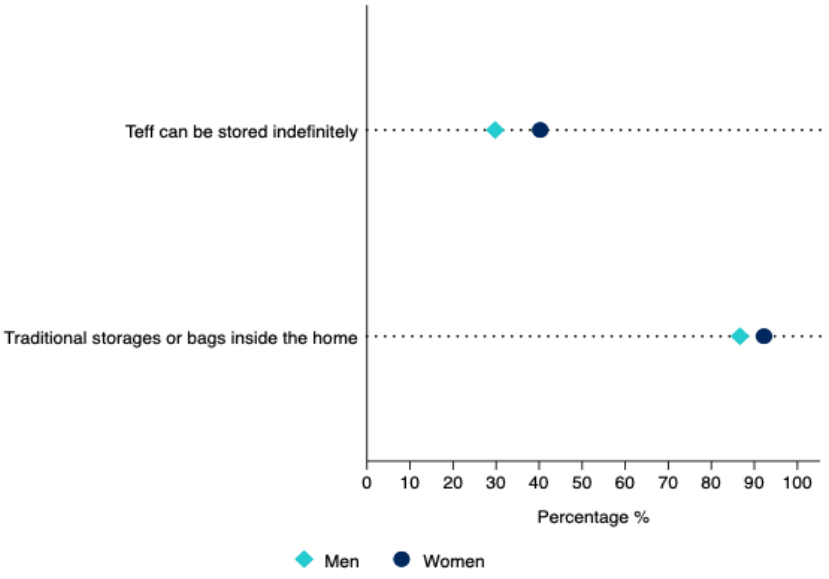
Figure 37: Threshing knowledge questions, % correct by gender (n = 1,110)



Knowledge of Post-harvest Management and Storage

One-third (33%) of respondents have complete knowledge on teff storage methods. On average, women answer 0.16 more questions on post-harvest best practices correctly (p = 0.001). Regarding storage location, around 90% of farmers mentioned teff can be stored using traditional storage methods or kept in bags inside the house. However, farmers have different opinions on the amount of time that teff can be stored for without loss. If accurately stored and protected from rats and water, teff can last more than four years, while most farmers (65%) believe it can be stored for a maximum of four years.

Figure 38: Post-harvest and storage knowledge questions, % correct by gender (n = 1,110)

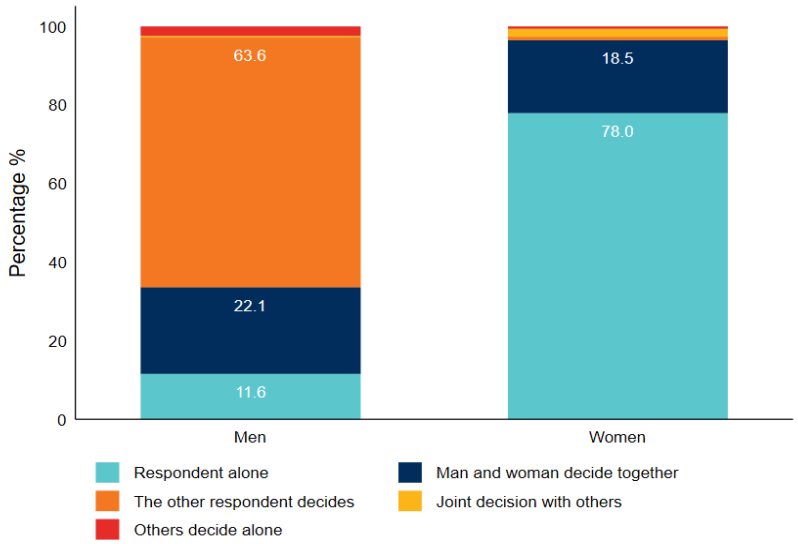


Appendix 4: Decision-making on Nutrition and Food Purchases

Decisions on Nutrition

Household nutrition is a decision-making area dominated by women with significant gender differences. In our sample, 90% of women make the decision alone on what food to prepare, while 80% of male respondents agree that it is the woman alone who decides. A few (16%) men state this decision is taken together with the female respondent, while 9% of women report making this decision together with the man. Both men and women report that men are not the decision makers in this respect: only 1% of women and 3% of men state it is the man who decides what foods to prepare every day. The reported differences between men and women may stem from overconfidence bias on behalf of men.

Figure 39: Person Responsible for Decision Making - What Food Respondents Can Eat



These decision-making patterns on food preparation appear to reflect both men and women's preferences, as well as cultural norms. The domestic sphere is traditionally seen as the woman's area of responsibility and expertise. Many men (76%) prefer the female respondent to decide, while 78% of women prefer to decide by themselves what food to prepare everyday. Joint decisions are preferred by 17% of male respondents and 15% of female respondents. Finally, 4% of men would prefer to decide by themselves what food to prepare everyday, while 5% of women would prefer that the man makes this decision.

Decisions on Household Food Purchases

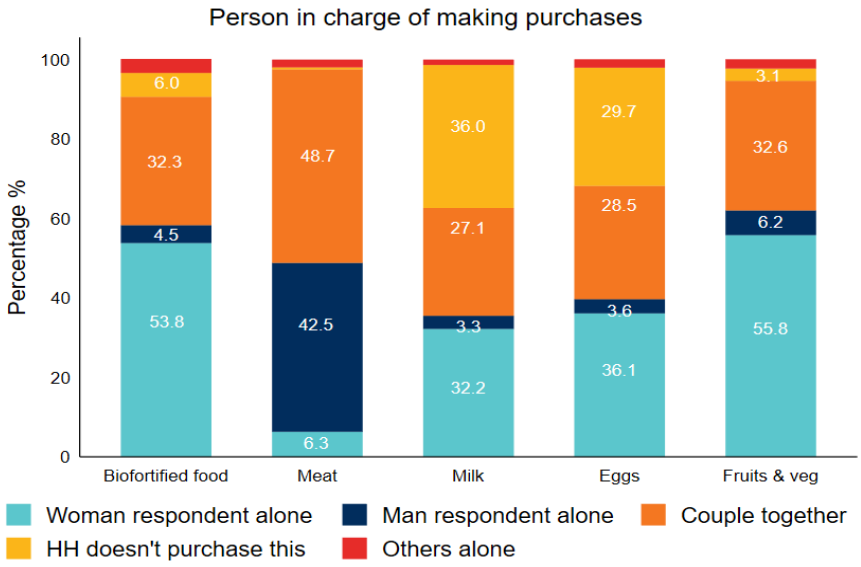
In terms of food purchases, women have more decision-making power than men with respect to small and large quantities of food and certain food groups. When purchasing small quantities of food (less than 5 kg), 52% of women report making decisions alone, while 40% make decisions together with the male respondent. However, 61% of men report the woman alone is in charge of making decisions over small quantities of food, while 28% report making these decisions together with her. Only 6% of men report making decisions alone on purchasing small quantities of food, and 6% of women report men making these decisions.

For large quantities of food (more than 5 kg), we observe a higher share of joint decision making. Approximately half of men (52%) and women (53%) report making the decision together.

However, the share of women deciding alone is still significantly higher than that of men — 26% of men and 33% of women report women decide alone when purchasing large quantities of food, while 18% of men and 12% of women report men make these decisions alone.

Women also have considerable decision-making power over purchasing most food groups, while men have more power over meat purchases. Over half of women (54%) purchase biofortified food (e.g., oil, cereals, pasta) or fruit and vegetables alone, while 32% purchase these items together with the male respondent. Milk and eggs tend to be consumed on holidays or feasts, and generally do not form part of a staple Ethiopian diet on regular days. They also tend to be produced within the household. As a result, 36% of households indicated they do not purchase milk, and 30% do not purchase eggs. When they do, in 32% and 36% of cases, respectively, it is the woman who is in charge of purchasing them, while in 28% of cases, the man and the woman purchase these food items together. Interestingly, meat appears to be the food group where men have decision making power — in 43% of cases, the man alone is in charge of buying meat, while in 49% of cases, the purchase is done by the couple.

Figure 40: Person Responsible for making purchases



Appendix 5: Additional Farmer Challenges with BP Adoption

Change to plowing month

Some farmers noted a change in recent years in the advised month to start plowing and the advised number of times a plot sold be tilled. One male farmer explained, "previously crop rotation was common. As a result, farmers started to plow earlier starting from March if the land is planted like black seed, wheat, or maize which they argue is easy to plow. But now farmers plant similar types of crops like teff for several years continuously. As a result, the land is hard to plow by the winter unless it gets rain." These farmers opted to plant in April or May as a result. Many farmers also mentioned that the recommended number of tills has changed in recent years, and plowing used to be conducted less. One male farmer explained, "our plowing system has also changed… previously we plowed the land only two or three times but now we plow that land maybe five or six times based on the nature of the land." Several farmers mentioned this change in tilling frequency as one of the biggest changes to best practices in recent years.

Mixed reaction to Kuncho seeds

In the FGDs and interviews, farmers had mixed reactions to the Kuncho seeds. Some farmers agreed that it was highly productive compared to previous seeds, with one male farmer explaining, "[Kuncho] seed is very white… is supplied and provided by the government… [and is] more productive than the previous one." Another farmer, however, mentioned it was time for a new improved seed with better productivity, saying, "more quality and more productive improved seeds for teff should be provided for the farmers. So far we have been using Kuncho teff seeds for the last ten years, but haven't gotten a new one yet.." Other farmers took issue with the appearance of Kuncho teff and the quality of the injera produced with it. One farmer noted, "I may not take their white teff seeds for planting because our land turns it into a brown teff." One crop expert noted that, "women farmers claim that kuncho teff is not good for injera – it immediately dries, and is not soft enough to eat as like that of other seeds."

Recent challenges with fertilizer

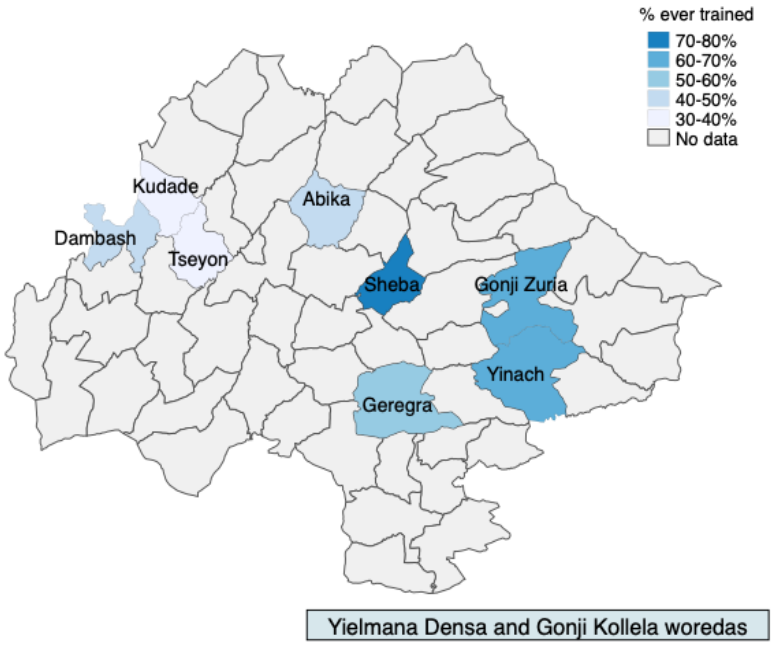
Gonji Kollela and Yielmana Densa experienced a severe shortage of fertilizer during the study, particularly for Urea, leading to very high prices and low availability. This was mentioned very frequently by farmers, crop experts, and DAs in the FGDs and IDIs. This shortage has therefore impacted the results pertaining to adoption of fertilizer best practices.

Farmers expressed deep frustration at cooperatives and the government for the management of the shortage, blaming the war and corruption for the high prices and lack of access. One male farmer stated, "Yes, of course the war has impacted our farming practices. As a result of blockage of roads here and there, there was a shortage of fertilizer here in the area. It was sold as like contraband, farmers were forced to buy from the private merchant with high cost." Others blamed cooperatives, one male farmer saying, "For me that was not due to shortage of fertilizer by itself but the way cooperatives managed things here. They do not let the farmers take it [fertilizer] in advance; we are always made to get it at the very peak time which could create uncertainty and shock."

Farmers in the focus group discussions did express concerns over the overuse of fertilizer, and its impact on the land. One farmer noted that, "fertilizer utilization is becoming a serious issue; the land is now becoming useless." Another male farmer added, "the fertility of the land has been reduced as a result of the amount of fertilizer used."

Appendix 6: Map of training attendance, by kebele

Figure 41: Proportion of farmers who have ever attended a teff training, by kebele (n=1,110)



Appendix 7: Literature Review on Teff and Teff Farming

Teff in Ethiopia

Teff is a staple crop in both Ethiopia and Eritrea, where it is used mainly to make injera - a spongy flatbread that can be eaten with most meals. Teff products accounted for 12% of Ethiopian food expenditures in 2011, making it the most important cereal crop in Ethiopia.[95] It is also valuable to farmers as a cash crop – while teff has low yield per hectare compared to other cereal crops, the price per kilogram is significantly higher than any other cereal in Ethiopia.[96] Teff accounts for approximately 20% of all cultivated area in Ethiopia.[97] Oromia produces approximately 48% of teff nationally, followed by Amhara which produces 39%.[98] There has been an increase in teff production over the past few decades, which has been attributed primarily to the increase in the amount of land planted with teff.[99]

Farmers value teff not just because it is an important crop for home consumption and valuable at the market. Teff is also valued for its fine straw which is used for both animal feed and for construction.[100] It is a resilient crop when compared to other cereals – it can withstand periods of drought and flood.[101] It is easily intercropped with many other crops and can be grown in many agro-ecological zones and altitudes. Further, it attracts few insect pests and diseases, and post-harvest loss is minimal given low intrusion by storage insect pests.[102]

Teff is primarily made up of complex carbohydrates and has a similar protein content to common cereals (like wheat). Teff is a good source of fatty acids, fiber, calcium, and iron (compared to other cereals).[103] Teff was long thought to be very high in iron, but more recent studies have shown that high iron test results come from the soil mixed with the grain, not the grain itself.[104] Teff is also gluten free, and there is a growing market for it outside of Ethiopia.[105]

Despite the importance of teff in Ethiopia, it is referred to as an “orphan” crop, as it is relatively understudied.[106] International crop research and governmental bodies are primarily interested in cereal crops like maize, wheat, and rice that are grown internationally and that produce higher yields than teff traditionally does. Teff has not yet benefited from decades of research focused on increasing its yields (as many other staple crops have), and there is still much to be learned about every stage of the value chain of teff. Teff is a highly valuable crop in the Ethiopian context, and with the benefits of a resilient crop that is a primary food source for the population of Ethiopia, it is worth studying more.

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[95] Minten, B., A. S. Taffesse, and P. Brown. 2018. The economics of teff: Exploring Ethiopia’s biggest cash crop. International Food Policy Research Institute (IFPRI).

[96] Minten et al., 2018

[97] Ethiopia, CSA (Central Statistical Agency). 2020. Agricultural Sample Survey 2019/2020. Area and Production of Major Crops. (Private Peasant Holdings, Meher Season). Addis Ababa: CSA

[98] Ibid.

[99] Demeke, M., and F. Di Marcantonio. 2013. Analysis of Incentives and Disincentives for Teff in Ethiopia. Technical notes series. Rome: Monitoring African Food and Agricultural Policies (MAFAP), FAO.

[100] Minten et al., 2018

[101] Fufa, B., B. Behute, R. Simons, and T. Berhe. 2011. Strengthening the Tef Value Chain in Ethiopia. Mimeo, Agricultural Transformation Agency (ATA), Addis Ababa.

[102] Minten et al., 2018

[103] Minten et al. 2018.

[104] Baye, K. (2014). Teff: nutrient composition and health benefits. Ethiopia strategy support project, IFPRI.

[105] CBI. (2020). The European market potential for teff. https://www.cbi.eu/market-information/grains-pulses-oilseeds/teff/market-potential

[106] Fufa et al., 2011

Traditional Agricultural Practices of Teff Farmers

Teff farming households in Ethiopia usually farm teff as part of a rotation with other crops, and on multiple different plots of land. In one study, an average of four separate plots was used for growing teff.[107] Farmers do not usually plant teff two years in a row; it is often rotated with onion, chickpeas, common beans, and lentils.[108] Family labor is the primary labor used to produce teff (63% of the labor), while hired labor accounts for 11% and reciprocal exchange of labor makes up 22% of labor used to produce teff.[109] While we detail the general consensus on gender roles for particular activities throughout this section, these vary by specific location, household, and who was interviewed in each study. If only household heads (usually men) are interviewed about time use or labor, they often over-report their own activities on a plot, and underreport other household member's activities.

On average, 70% of plots are planted with traditional seeds, while 30% use improved seeds. Of the seeds used, 78% were obtained from a farmer's own harvest in previous years.[110] Teff varies from magna (very white), nech (white), sergegna (mixed white and red), and key (red). Magna (very white) is the most valuable in the market, descending in value to key (red). Nech (white) are the most common, making up 52% of plots; this is followed by 20% key (brown/red), 17% magna (very white), and 11% sergegna (mixed).[111] Red and mixed teff are often used for home consumption.[112]

Land Preparation

Plowing is traditionally done 2-5 times for a plot that will be planted with teff. In most cases, plowing is done with the help of animals (usually oxen, but also horses or donkeys) owned by the farmer.[113] Adequate land preparation is important for teff as the seeds are quite small, so the soil needs to be loose so that the seeds can germinate.[114] Plowing is completed before sowing, and generally occurs before July. Men generally lead the activity of land preparation – one study found that 96% of labor on land preparation was carried about by men.[115,116]

Sowing

Sowing is traditionally done by 'broadcasting' – scattering the seeds by throwing onto the surface of plowed soil. This system uses a relatively high quantity of seeds per hectare (44 kg/hectare).

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[107] Minten et al., 2018

[108] Gizaw, B., Tsegay, Z., Tefera, G., Aynalem, E., Abatneh, E., & G. Amsalu. (2018). Traditional Knowledge on Teff (Eragrostistef) Farming Practice and Role of Crop Rotation to Enrich Plant Growth Promoting Microbes for Soil Fertility in East Showa: Ethiopia. Agricultural Research and Technology. Wachemo University, Ethiopia.

[109] Ogato, G.S., Boon, E.K., & J. Subramani. (2009). Improving Access to Productive Resources and Agricultural Services through Gender Empowerment: A Case Study of Three Rural Communities in Ambo District, Ethiopia. Journal of Human Ecology, 27(2).

[110] Ibid.

[111] Minten et al., 2018.

[112] Minten, B., S. Tamru, E. Engida Legesse, and K. Tadesse. (2013). Ethiopia's Value Chains on the Move: The Case of Teff. ESSP Working Paper 52. Addis Ababa: ESSP.

[113] Ibid.

[114] Ebba, T. 1969. Teff (Eragrostis tef): The Cultivation, Usage, and Some of Its Known Diseases and Insect Pests. Part I. Experiment Station Bulletin 60. Haile Selassie I University (HSIU), Ethiopia.

[115] Tekalign, S., Eneyew, A., Mitiku, F. (2020). Gender roles in teff value chain in Borecha District of South Western Ethiopia: husband and wife comparisons. J. Agribus. Rural Dev., 1(55), 93–105.

[116] Vandercasteelen, J., Dereje, M., Minten, B., Taffesse, A. S. (2018). Labour, profitability and gender impacts of adopting row planting in Ethiopia, *European Review of Agricultural Economics*, Volume 45, Issue 4, September 2018, Pages 471–503.

Sowing traditionally occurs from the second week of July to the first week of August, with slight variation based on soil quality, altitude, and region.[117]

One focus practice for teff production in the past decade has been planting in rows or transplanting seedlings, as opposed to the traditional broadcasting method.[118] This system is potentially advantageous as it uses less seeds per hectare (10-15 kg/hectare), which reduces competition between seedlings and allows for easier weeding and fertilizer application. Experiments in planting teff in rows in controlled environments showed a three-fold increase in productivity.[119,120] A scaled-up version of this program demonstrated a 70% increase in yields with 70,000 farmers in 2012.[121] In 2013, the government of Ethiopia expanded the program to attempt to reach 2.5 million teff farming households.[122]

The benefits of row planting have not been fully realized for the average Ethiopian teff farmer. This is largely due to the labor constraints of planting in rows over broadcasting. Sowing by broadcasting one hectare of teff took 42 person-hours; row planting took 139 more person-hours (or approximately 20 person-days extra) per hectare.[123] These additional hours fell disproportionately on the women in the household, who are largely responsible for sowing (although men and children are also involved in this activity).[124,125] Almost all farmers who went through the extension program were aware of the benefits of row planting, but after one season of experimenting planned to only continue the practice on a small portion (on average, 20%) of their land.[126] Efforts to invent a teff row planter is underway. Aybar Engineering introduced the Temesgen Row Seeder in 2019. It can be carried on the chest of a farmer and sow teff and fertilizer 5 rows at a time – work that would usually require 10 people.[127] Other companies have also developed similar versions.

Weeding & Pest Management

Weeding is done usually once or twice a season for a teff field. Herbicides are used by 65% of farmers, but weeding is still necessary at least once per season.[128] Row planting may reduce weeding times, but reports vary. In a controlled setting weeding time is reduced, but in some settings broadcasting may reduce weeding needs as a high number of teff seeds may control weeds.[129] Both men and women are involved in weed control.[130,131]

Fertilizer Application

[117] Minten et al. 2018

[118] Fufa et al. 2011

[119] Berhe, T., Z. Gebretsadik, S. Edwards, and H. Araya. 2011. "Boosting Teff Productivity Using Improved Agronomic Practices and Appropriate Fertilizer." In Achievements and Prospects of Teff Improvement, 133–140. Proceedings of the Second International Workshop, November 7–9, 2011, Debre Zeit, Ethiopia.

[120] ATA. (2012). Annual Report: Transforming Agriculture in Ethiopia. Addis Ababa, Ethiopia.

[121] ATA (Agricultural Transformation Agency). (2013). Results of 2012 new teff technologies demonstration trials draft report VF. Agricultural Transformation Agency, Addis Ababa, Ethiopia.

[122] Vandercasteelen et al. 2018

[123] Minten et al., 2018.

[124] Tekalign et al., 2020.

[125] Minten et al., 2018.

[126] Vandercasteelen et al., 2018.

[127] Aybar Engineering. http://www.aybareng.com/

[128] Minten et al., 2018.

[129] Vandercasteelen et al., 2018.

[130] Tekalign et al. 2020.

[131] Minten et al. 2018.

In most areas, teff farmers primarily use urea and/or NPS and blends with some micronutrient in the form of NPSB, NPSZn, NPSBZn inorganic fertilizer to fertilize their teff fields. Only 10% of farmers use organic materials or manure on teff. In one study, 89% of teff plots received NPS and 79% received urea. NPS was mostly used once, while urea was applied in equal measures once and twice (with a few farmers applying it three or more times).[132] Both men and women are involved in fertilizer application.[133]

Harvesting

Harvesting teff traditionally lasts from the beginning of October to the end of January (depending on the region, rainfall, altitude, and other local conditions). The average growing season of teff is 17 weeks. Farmers harvest teff by mowing with sickles after the crops are matured and dried in the field. The crops are piled in the field and then transported to the threshing area.[134] Some studies report that men are responsible for harvesting, and some report that women are more involved than men.[135,136]

Threshing

After harvesting, teff dries for an average of 40 days before threshing. Farmers prepare the threshing area by coating it with a layer of cattle dung. Once the teff has been brought to the threshing area, the teff is threshed by oxen trampling the teff. Further separation of seeds and cleaning is done by hand with traditional tools.[137] There are some new technologies in this area that some farmers have started using, including multi-crop threshers and seed cleaners.[138]

Post-Harvest Handling & Storage Management

Once the teff has been threshed, farmers either sell the teff grains or consume them themselves. Farmers rarely sell the straw and instead use it themselves for animal feed or construction. Teff can be stored in traditional storage structures called gotera or gota, or in synthetic sacks.[139] Teff grains can be used up to three to five years after threshing without large losses.[140]

Gender and Teff

Researchers have found that teff plots managed solely by women are less productive.[141] This can possibly be explained by less access to, and control of productive resources, extension information, and household labor being concentrated on plots managed by men in MHH. Hailu et al. noted, “that teff output could be increased by approximately 25 percent with the available inputs and technology through investments directed to improved gender-sensitive extension service and infrastructure development.”[142] Like many other value chains, women in teff farming households

[132] Ibid.
[133] Tekalign et al. 2020.
[134] Ibid.
[135] Tekalign et al., 2020.
[136] Minten et al., 2018.
[137] Ebba, 1969
[138] Minten et al., 2018
[139] Ebba, 1969
[140] Minten et al., 2018
[141] Gender and Agricultural Advisory Services. (2020). Issue Brief. BMGF.
[142] Hailu, G., Weersink, A., Minten, B. (2015). Rural Organizations, Agricultural Technologies and Production Efficiency of Teff in Ethiopia. International Conference of Agricultural Economists.

have limited access to land, irrigation, extension services, credit, rural organizations, and other productive resources.[143]

Gender is a large driver of adoption of BPs for many value chains, and teff is no exception. Experience on teff, farm size, distance to the market, participation in the farmers' association, extension, and availability of credit are all correlated with the adoption of BPs on teff.[144] These variables are also highly dependent on gender, both the gender of the household head and for individuals within households.

In terms of gender roles in teff production, men are traditionally responsible for preparing, sowing, and applying fertilizer in teff fields, while women and children are more involved in weeding, threshing, and any post-harvest handling. Application of new technologies like row planting require women and children to supply more labor to sowing and fertilization (as well as weeding and threshing). Weeding is the most labor-intensive activity, followed by threshing.[145] There is some risk in promoting labor-intense technologies (like some improved technologies and practices in teff) if farming households are labor constrained, or if the labor will fall disproportionately on tasks traditionally completed by women.[146]

In a study done on teff farming households in Oromia, Tekalign et al. found that both men and women participate in the production, processing, and selling of teff, while men largely control the cash generated from teff. Men dominated land preparation and marketing, while women dominated weeding and harvesting activities. When asked about extension services, 97% of men had accessed some extension services, while only 67% of women had.[147]

[143] Ogato et al., 2009.

[144] Milkias, D. (2020). Factors Affecting High Yielding Teff Varieties Adoption Intensity by Small Holder Farmers in West Showa Zone, Ethiopia. International Journal of Economy, Energy and Environment, 5(1).

[145] Vandercasteelen et al., 2018.

[146] Ibid.

[147] Tekalign et al., 2020.