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Gender dynamics around introduction of improved forages in Kenya and Ethiopia

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Abstract

Improved forages of genus *Brachiaria* and *Panicum* grasses were introduced to men and women farmers in western Kenya and southern Ethiopia. To provide an understanding of the social and demographic characteristics of farming systems, a household survey was implemented in 2018/2019. In 2020, a complementary qualitative study was conducted to understand: (a) gender dynamics in accessing forage planting materials: (b) role of forage trait preferences, and (c) how the introduction of forage varieties influences gender relations in households. Forage seed/splits were accessed through women's groups. In Kenya, men and women were advised to source more forage seeds from private seed companies for scaling. In Ethiopia, men prioritized "fast regrowth" and women "nutritious biomass" traits; in Kenya, men prioritized "nutritious biomass" and women "how fast forage splits could be established" traits. The sale of the forage cuttings appeared to provide promising marketing opportunities for women, who were able to control the income generated. The introduction of improved forages, which are grown close to homesteads, reduced the time men and boys spent grazing livestock while increasing the time women and girls spent harvesting fodder. Following gender sensitivity training provided alongside forage introductions, Ethiopian men reported being involved in forage harvesting, chopping, and feeding against prevailing norms while the Kenyan women took on greater decision-making roles. These positive outcomes in gender equity suggest that the integration of gender and forage technology trainings can secure significant gains not only for women, but also for the men in the households.

1 | INTRODUCTION

Livestock contributes to the livelihoods and nutritional security of almost a billion people globally (Robinson et al., 2014; Thornton, 2010) and more than 103 million people in East Africa alone (FAO, 2019a, 2019b, 2019c). Mixed crop–livestock production systems dominate African smallholder farming. On these "mixed" farms, livestock provide traction, transport, and manure for crop production as well as a regular cash income, insurance, and high-quality food (milk, meat, and eggs). In contrast, crops provide both food for the family and feed for the family's livestock, the latter being either planted fodder or the stalks, leaves, and other residues of food crops (Herrero et al., 2016).

Abbreviations: CIAT, International Center for Tropical Agriculture; ILRI, International Livestock Research Institute; RHoMIS, Rural Household Multi-Indicator Survey; SACE, Send a Cow Ethiopia, a nongovernmental organization; SACK, Send a Cow Kenya, a nongovernmental organization; SNNP, Southern Nations, Nationalities and Peoples Region, Ethiopia; SSGI, semistructured group interview.

Livestock are a particularly important asset for women, because women constitute roughly two-thirds of the poor-livestock keepers worldwide (Thornton et al., 2002) and they can own, accumulate, or manage animals more easily than they can own or control land and other household assets. Farm animals provide the daily food and income that women use to provide their families with nutritious meals (Dominguez-Salas et al., 2019).

Despite the huge potential of the livestock sector to improve the livelihoods of women and men and support national economies, livestock productivity in low- and middle-income countries has remained low (Negassa et al., 2012; Shapiro et al., 2015). This is mainly due to feed shortages as well as to poor livestock health, genetics, and services. Poor-quality and insufficient feed are major, and growing, problems for livestock smallholders and herders worldwide (FAO, 2019b), with grazing lands declining in both size and productivity (Headey et al., 2014; Mekasha et al., 2014; Mekuria et al., 2018) and African ruminants subsisting mainly on poor-quality crop residues (Duncan et al., 2016; Ghimire et al., 2015). Such poor diets are responsible for the continent's large yield gaps (Henderson et al., 2016). New livestock feed and forage interventions are therefore viewed as promising key entry points for significantly enhancing African livestock productivity, while also delivering synergetic environmental benefits (Paul et al., 2020). The introduction of cultivated forages, for example, is estimated to increase smallholder milk yields by more than 40% (Mayberry et al., 2017). East Africa has an emerging market for improved forage varieties that can enhance rural livelihoods and generate important income for farm women (Galiè, unpublished data, 2021).

Several types of grasses, herbaceous legume forages, and fodder trees have been introduced in the smallholder livestock systems in East Africa. Yet adoption rates of these novel improved forage varieties are generally low in sub-Saharan Africa (Gebremedhin et al., 2003; Negassa et al., 2016). This is due to lack of farmers' access to technical information, markets, productive assets needed to grow the forages, institutional support, and forage varieties with traits preferred by farmers (Fliegel & Kilvin, 1966; Paul et al., 2021). These constraints are particularly acute for women (Ragasa, 2012; Van Eerdewijk & Danielsen, 2015).

While most agricultural technologies are intended to be productivity-enhancing, value-adding, and labor-saving, all do not equally benefit poor women and men (Ragasa, 2012). New technologies are frequently developed for the needs of farmers and are disseminated with no attention to the social and gender dynamics that mediate the introduction of new technology in a given household. Such technologies often increase women's labor burdens and reduce women's control over resources such as land, and men often take over the production and marketing of products that become financially lucrative (Beuchelt, 2016; Meinzen-Dick et al., 2011; Momsen, 2020; World Bank et al., 2008). This study was undertaken to help identify options that allow women and men to make use of and benefit equally from improved forages and forage technologies. This study assessed the preferences of women and men for forage traits and the effects on them of forage workloads and decision-making relative to gender-equitable access to improved forage varieties within a "Grass2Cash" project (short name for a BMZ-funded project titled "Improved forage grasses: Making the case for their integration into humid-to-subhumid livestock production systems in Kenya and Ethiopia," led by the Alliance of Bioversity International and CIAT under the CGIAR Research Program on Livestock) (Bezabih et al., 2019; Karimi et al., 2020).

In 2018, two CGIAR centers, the International Center for Tropical Agriculture (CIAT) and the International Livestock Research Institute (ILRI); two nongovernmental organizations, Send a Cow Kenya (SACK) and Send a Cow Ethiopia (SACE); and other partners, with support from Germany's Federal Ministry for Economic Cooperation and Development (BMZ), designed the Grass2Cash project to evaluate and promote improved forage varieties among smallholder women and men farmers in four counties in Kenya and three districts (woredas) in Ethiopia. Following a feed system diagnosis using Feeds Assessment Tool , the following grasses were introduced to the target community groups: napier grass (*Pennisetum purpureum* Schumach.), desho grass (*Pennisetum pedicellatum* Trin.); *Brachiaria* spp.; and guineagrass (*Panicum maximum* Jacq.) cultivars. Although all of these forages have recently been renamed, for example, *Pennisetum purpureum* to *Cenchrus purpureus, Panicum maximum* to *Megathyrsus maximus* and *Brachiaria* spp. to *Urochloa* spp. (Cook & Schultze-Kraft, 2015), we will use their previous name throughout this paper as these are more widely known. In western Kenya, a recent modelling study estimated that 20% of target farming households could benefit from increased income and food availability following the introduction of guineagrass (Caulfield & Paul, 2021).

Core Ideas

- Use of participatory research enhanced farmers' knowledge about growing improved forages.
- Men and women farmers preference for improved forages were based on preferred traits.
- Integrating forage introductions with gender sensitivity training benefitted household relations.
- Time spent on grazing cattle by men reduced while women and girls time harvesting forages increased.
- Forage sales began to emerge as a source of income benefitting women in particular.

The project designed an on-farm participatory co-learning process to evaluate newly introduced forages in controlled demonstration trials managed by researchers and on individual farmers' fields managed by farmers themselves. In both cases, the forage evaluation involved active participation of farmers and local extension officers to identify best-bet grass options for the respective locality where the experiment was implemented (Snapp, 1999).

The Grass2Cash project was implemented in four counties in western Kenya–Busia (Kingadole and Nasira sublocations), Bungoma (Ndegelwa and Napara sublocations), Siaya (Karemo sublocation), and Kakamega (Isongo sublocation). Eight demonstration trial sites (two per county) were established among eight farmer groups. Project staff provided the farmers hosting the demonstration trials with seeds for 11 forage grasses to plant. Agronomic operations, such as weeding, fertilization, and harvesting, were planned and programmed by the researchers but implemented together with the members of the farmer group. Since seed value chains are relatively well developed in Kenya, the farmers were advised to buy seeds from a seed company stocking the seed and/or to obtain vegetative splits from the demonstration farms if they desired to expand their area under forages. In Ethiopia, the research was implemented in three woredas (equivalent to districts) in the highlands of southwestern Ethiopia's Southern Nations, Nationalities, and Peoples' Region (SNNPR)–Damot Woyde Woreda (Kinddo Kokyo and Mayo Kote *kabeles)*, Damot Gale Woreda (Wogera and Shasha Gale Kebele), and Soddo Zuria Woreda (Dalbo Atwaro and Dalbo Wogene Kebele). Twenty-four self-help forage farm groups spread over the six target *kebeles* were recruited and 96 forage lead farmers, consisting of 37 women and 59 men, were tasked with supporting their group members with the learning process. These forage lead farmers were trained in forage management and handling, shared experiences through visits to other groups, and attended forums where they evaluated their progress, challenges, and set goals. Four improved forages were introduced in Ethiopia: desho grass, napier grass, *Brachiaria decumbens* Stapf, and Mulato II. Later introductions included intercropping napier with *Desmodium*, a legume; intercropping oat (*Avena sativa* L.) with vetch (*Vicia sativa* L.); and alfalfa (*Medicago sativa* L.). For fodder introductions on their own farms, the Ethiopian farmers were advised to use vegetative splits, as no fodder seeds were being sold in the country. As there were no well-developed seed value chains in Ethiopia, especially for forages, the Grass2Cash project sourced vegetative splits for all the forage varieties it was promoting from the ILRI Herbage Seed Unit, in Addis Ababa. The Ethiopia project team rented a common farm on which to plant 15 different forage types in a demonstration plot, which was managed by a hired field technician with the women and men farmers participation. The participating farmers from the surrounding communities then selected two to three forages to plant on their farms.

All of the participating farmer group members were trained in good agronomic practices recommended by the Grass2Cash project, such as how to lime soil to neutralize soil acidity; to space forage plants appropriately within and between rows; to weed the plants; and to harvest and make hay of the fodder for feeding to animals. The farmers learned by doing, observing, and collecting data on key indices. When the forage plants were fully grown, the farmer groups hosted field days to let the wider community know about the improved forages they were testing. Starting in the second season of testing the forages, the participating farmers selected the forage types they liked the most to plant on their farms and began to allocate land and other resources to grow them.

Send a Cow, the key implementing partner of the Grass2Cash project in Kenya and Ethiopia, organized the dissemination of the forage materials and seeds in keeping with their approach to development, which requires project participants to attend a series of community trainings and dialogues regarding 12 of their cornerstone principles. Two of these principles became "enablers of change" for the Grass2Cash project: (a) *passing on a gift* encouraged the project's participating farmers to share their forage splits with their neighbors, friends, and relatives, once they had successfully established their own forage plants and (b) *gender and family focus* encouraged men and women to share decision-making, animal ownership, labor provision, and any benefits generated by the project.

The project benefited more than 2,500 households (42% headed by women, 58% by men) in the two countries through training in good feed management practices, disseminating good-quality seeds of improved forage varieties for planting on their farms, and promoting sales of forages by farmers who did not own cattle or who had excess forages.

2 | MATERIALS AND METHODS

During the implementation of the Grass2Cash project, two surveys were carried out: (a) a cross-sectional household survey that provided quantitative data were first collected to provide an understanding of the basic social and demographic characteristics of the fodder farmers in the project sites (e.g., age, ethnicity, sex, socioeconomic status) as well as their forage uses and preferences (Paul, Odhiambo, et al., 2019; Paul, Tigabie, et al., 2019; Paul et al., 2021; Waweru & Paul, 2021) and (b) A qualitative survey of gendered forage trait preferences and how the use of improved forage varieties influenced household gender relations. This survey was guided by three questions: (a) Were there gendered differences in forage trait preferences? (b) How was the use of improved forage varieties influencing gender relations in the

households? (c) What ways enhance gender-equitable access to preferred forages in the future? This qualitative study was designed not to assess adoption but rather to shed light on if and how use of improved forages influenced gender relations in households, and specifically to determine any harmful or beneficial consequences affecting women's empowerment.

In this section we described the methods used to collect the cross-sectional quantitative data and the gender-focused qualitative data.

2.1 | Study sites

2.1.1 | Rural household multi-indicator survey

The quantitative survey was conducted by a team of trained enumerators among 203 households in six sites across three woredas in Ethiopia (1–20 May 2019), and 198 households in eight sites across four counties in Kenya (2–16 Apr. 2019). Sample sizes were calculated to be representative at village or kebele level (95% confidence level). In Kenya, complete household lists per target village were generated by village authorities, and households were randomly selected representative to its total population. In Ethiopia, the sampling followed a stratified random strategy, using a complete list of 300 initial beneficiaries and complete kebele household lists. An anonymized version of the dataset is published on CIAT Harvard Dataverse (Paul, Odhiambo, et al., 2019; Paul, Tigabie, et al., 2019). The Rural Household Multi-Indicator Survey (RHoMIS) used for data collection is a standardized digital data collection tool for interviewing smallholder farm households (https://www.rhomis.org). Collected data include family size and composition and education, cultivated land and crops, livestock holdings, crop and livestock productivity, value and amount of sales, input use, gendered decision making and off-farm income. An additional module on forages was added to the standard survey tool, including questions on forage species and area, management, and forage appreciation. Descriptive statistics on the farming systems population and forage growing practices are reported in Paul et al. (2021) and Waweru and Paul (2021).

2.1.2 | An additional qualitative survey

A qualitative survey was designed to complement the RHoMIS quantitative survey in 2020, 2 yr after the inception of the Grass2Cash project. This qualitative survey was undertaken with a subset of respondents in four of the seven Grass2Cash study sites–two of the three districts in Ethiopia and two of the four counties in Kenya (Table 1). This survey was to explore in more detail gendered management of livestock and forages, gendered trait preferences for forage varieties, how the introduction of improved forages in farmer groups was affecting gender relations in households, and future plans for forage cultivation.

In each of these intervention sites (Table 1), two single-sex semistructured group interviews (SSGIs)–one with women and another with men–were conducted, resulting in a total of eight SSGIs. Each SSGI had 9–12 participants, resulting in a total of 86 respondents (43 men and 43 women).

The number of participants to be interviewed was established via a process of saturation reached when new incoming data produced little or no new information about a given research question (Given, 2015).

Participants were selected purposefully to represent as much diversity as possible within key criteria, which included individuals from households with: small or large forage plot size; control over household cattle held by women or men, responsibilities for selling forages and milk (assigned to men or women), and positive and negative experiences in adopting improved forage varieties.

2.1.3 | Implementation of SSGIs

The SSGI respondents consented to participate in the group discussions by filling out a participant's profile and a consent form. The SSGIs were guided by an experienced facilitator plus three enumerators and notetakers per country who had been trained by ILRI social scientists on the SSGI process and the broad questions to be asked. These questions focused on six topics: (1) forage varieties previously and currently cultivated in the area; (2) the gender division of labor in the household dairy enterprise, with a focus on cattle feeding; (3) access to seeds/planting materials for forage varieties; (4) fodder trait preferences; (5) changes in household workloads and decision-making relative to forage variety adoption; and (6) ideas about how to enhance forage adoption in the future. On the ranking of traits, we asked farmers to freely list good and/or bad forage traits out of their experiences of the common mother trials or the baby trials on their farms. We further asked them to note the best traits and the worst traits.

2.1.4 | Qualitative data analysis of the SSGIs

Recorded interviews were transcribed, translated into English, and uploaded to a qualitative analysis software package (NVivo). Three experienced qualitative researchers developed a codebook of deductive themes based on the study's research questions. Open coding was used to enable us to identify new themes, and assign them codes, as they emerged from the interviews. Nvivo qualitative data analysis software was used to review the data collected and make initial notes, code repeated ideas, concepts and elements, and group the codes into concepts and categories around

TABLE 1 Description of the Grass2Cash Project sites where the qualitative study was implemented

	Ethiopia		Kenya	
Factors compared	**Damot Gale**	**Soddo Zuria**	**Busia**	**Bungoma**
Rainfall, mm yr^{-1}	Bimodal; 900–1,400	Bimodal; 1,100–1,200	Bimodal; 1,200–1,500	Bimodal; 1,200–1,800
Elevation, m asl	1,500–2,900	1,500–3,200	1,000–1,500	1,500–2,500
Feed resources	Natural pastures, crop residues, desho grass, napier grass, Guatemala grass	Natural pastures, crop residues, desho grass, napier grass, Guatemala grass	Napier grass, concentrates, maize stover, sweetpotato vines	Grazing pasture, napier grass, concentrates, supplements
Major food crops grown	Wheat, teff, haricot bean, faba bean, pea, chickpea	Maize, wheat, barley, haricot bean, enset, cassava, potato, sweetpotato	Maize, bean, sugarcane, cassava, bananas, vegetables, groundnuts, pineapple	Maize, pulses banana, sugarcane, coffee, fruit trees

Note. Source: District/County offices of Agriculture accessed by Send-a-Cow. Scientific names: Guatemala grass, *Tripsacum andersonii*; teff, *Eragrostis tef* (Zuccagni) Trotter; haricot bean, *Phaseolus vulgaris* L.; faba bean, *Vicia faba* L.; chickpea, *Cicer arietinum* L.; barley, *Hordeum vulgare* L.; enset, *Ensete ventricosum* (Welw.) Cheesem.; cassava, *Manihot esculenta* Crantz; potato, *Solanum tuberosum* L.; sugarcane, *Saccharum officinarum* L.; banana, *Musa* X *paradisiaca* L.; groundnut, *Arachis hypogaea* L.; pineapple, *Ananas comosus* (L.) Merr.; coffee, *Coffea arabica* L.

the themes of access, forage preferences, participation and benefits men and women were getting. The results are presented for each country, starting with Kenya and followed by Ethiopia. Where possible, quotes from the participants are cited to illustrate selected themes and divergent views.

3 | RESULTS

This section presents both the quantitative and qualitative results. We first provide an overview of the site characteristics for both countries. We then organize the findings by country and provide characteristics of the respondents and of their livestock farms—based on the RHoMIS data—to then show the gendered experiences that the SSGI participants had interacting with the new forages.

3.1 | Characteristics of the respondents

The respondents in the RHoMIS household survey averaged 48 yr for men and 58 yr for women in Kenya (Table 2). In Ethiopia, men were 46 yr on average while the women were 53 yr. Compared to the male farmers, the female farmers were on average older and had significantly fewer years of education. The mean household sizes were 5.7 and 5.2 in Kenya and Ethiopia, respectively. Households cultivated land was 0.60 ha (1.48 acres) in Kenya and 0.62 ha (1.53 acres) in Ethiopia. A total of 40 respondents, 19 men and 21 women, were interviewed in the Kenya SSGIs. This is within the age range of farmers in the study area (45–60 yr) noted in the RHoMIS dataset.

3.2 | Cattle keeping, feed resources, and forage cultivation in the study sites

In the study sites, cattle are the dominant animals reared across these smallholder mixed crop–livestock farms. Approximately 63 and 91% of the interviewed households kept cattle in Kenya and Ethiopia, respectively. Table 3 present the kinds of cattle raised by men and women farmers in the study sites. Most farmers in both countries keep mostly (unimproved) local breeds of cattle; 23% of households in Kenya reported having improved cattle while only 4% of households in Ethiopia reported keeping improved cattle. In 59% of the Kenyan households, women owned the cattle either singly or jointly with male household members. The Kenyan households kept fewer castrates (steers) than cows. No significant difference was observed in herd structure by gender of the household head in Kenya.

Forage availability in both countries fluctuates between the annual dry and wet seasons. Forage cultivation was reported to provide more than 50% of feed resources for 52% of households in Kenya and 46% of households in Ethiopia for the dry season (Table 2). During the wet season, 75% of households in Kenya report their feed resources to be from cultivated forages compared to 37% of households in Ethiopia. See detailed analysis of the RHoMIS survey in Waweru and Paul (2021). We asked the SSGI participants if they were growing forages on their land and which ones they had chosen. The land allocated to forages, which are planted in dedicated plots, in the Kenyan study sites was about 0.33 ha for female respondents and 0.22 ha for male participants of the SSGI. In Figure 1, we present the forages that the SSGI participants reported growing.

TABLE 2 Household characteristics

Household characteristics	Kenya				Ethiopia			
	Male (n = 146)	Female (n = 52)	All (n = 198)	T statistics	Male (n = 170)	Female (n = 33)	All (n = 203)	T statistics
Mean age of the household head (by sex of the household head)	48.43	58.54	51.09	–4.49, df = 196 ($p \leq .01$)	46.170	53.180	47.310	–2.88, df = 201 ($p \leq .01$)
Household head's no. of years of schooling (by sex of the household head)	9.63	6.01	8.68	6.03, df = 196 ($p \leq .01$)	5.900	0.730	5.050	5.75, df = 198 ($p \leq .01$)
Household size (no. of household members) (by sex of the household head)	6.13	4.63	5.73	3.59, df = 196 ($p \leq .01$)	5.480	3.760	5.200	5.50, df = 201 ($p \leq .01$)
Cultivated land size (ha) (by sex of the household head)	0.63	0.53	.060	1.12, df = 196 ($p > .10$)	0.64	0.62	0.64	0.41, df = 201 ($p > .10$)
Feed basket for livestock								
Percentage of households with a dry-season feed basket composed of ≥half of these feeds	Cultivated forage	46.07			52.63			
	No cultivated forage	53.93			47.37			
	Dry forage residue	34.88			25.40			
	No dry forage residue	65.12			74.60			
	Gathered forage	60.00			34.52			
	No gathered forage	40.00			65.48			
Percentage of households with a wet-season feed basket composed of ≥half of these feeds	Cultivated forage	75.28			37.72			
	No cultivated forage	24.72			62.28			
	Dry forage residue	2.33			20.63			
	No dry forage residue	97.67			79.37			
	Gathered forage	46.25			47.62			
	No gathered forage	53.75			52.38			

Note. Source: Authors' estimation from Rural Household Multi-Indicator Survey (RHoMIS) dataset.

TABLE 3 Cattle breed categories kept by cattle-keeping households

Cattle characteristics	Descriptions of units used	Kenya			Ethiopia			All ($n = 312$)	*T* statistics
		Male ($n = 102$)	Female ($n = 36$)	All ($n = 138$)	Male ($n = 147$)	Female ($n = 27$)	All ($n = 174$)		
Cattle breed categories kept by cattle keeping households	Percentage of households keeping only local cattle	62.75	63.89	63.04	91.84	88.89	91.38		
	Percentage of households keeping both local and improved cattle	14.71	8.33	13.04	4.08	7.41	4.60		
	Percentage of households keeping only improved cattle	22.55	27.78	23.91	4.08	3.70	4.02		
	Total	100.00	100.00	100.00	100.00	100.00	100.00		
Cattle by sex and age categories	All cattle	3.67 (2.78)			2.68 (2.01)			3.12 (0.14)	−3.65, df = 310, ($p \leq .01$)
	Mature males (castrates)	0.50 (1.07)			0.74 (0.70)			0.63 (0.05)	2.34, df = 310, ($p \leq .05$)
	Cows	1.59 (1.32)			0.92 (0.86)			1.22 (0.06)	−5.46, df = 310, ($p \leq .01$)
	Heifers (immature females)	0.69 (1.04)			0.41 (0.68)			0.54 (0.05)	−2.81, df = 310, ($p \leq .01$)
	Bulls (breeding)	0.41 (0.89)			0.26 (0.56)			0.32 (0.04)	−1.78, df = 310, ($p \leq .10$)
	Calves (male and female cattle)	0.83 (0.96)			0.36 (0.51)			0.57 (0.04)	−5.56, df = 310, ($p \leq .01$)

Note. Source: Authors' estimation from Rural Household Multi-Indicator Survey dataset.

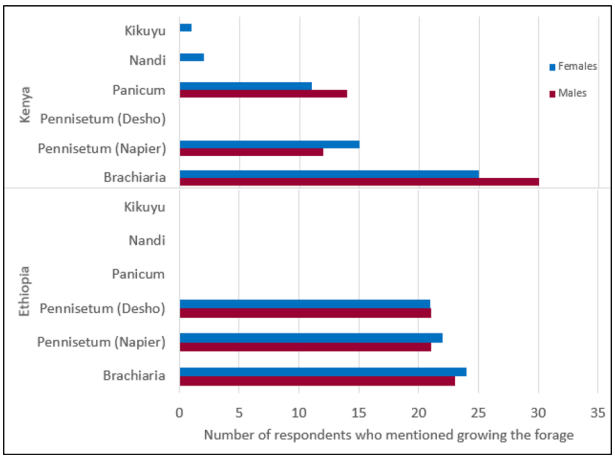

FIGURE 1 Forages that the semistructured group interview respondents mentioned that they are growing, by genus and country

3.3 | Results from the SSGI in Kenya

3.3.1 | Types of forages grown in Kenya

The SSGI respondents from Kenya reported having been introduced to napier grass and dairy animals through different extension initiatives over the years. Over time, they were also introduced to *Calliandra*, a leguminous tree whose leaves are used as livestock forage. Lucerne (*Medicago sativa* L. subsp. sativa) and sweet potato [*Ipomoea batatas* (L.) Lam.] vines were also important forages introduced into the community, they added. *Brachiaria* and *Panicum* forage grasses were the latest forage introductions, made through the Grass2Cash project. Figure 1 shows the forage types that SSGI farmers indicated they had picked from the mother trials to grow on their farms. All the respondents indicated currently growing multiple types of forages on their farms. The Kenyan men reported growing an average of three types of forages. One Kenyan female respondent reported growing no forages on her farm. In their SSGIs, women reported growing five types of forage crops–*Brachiaria*, napier, *Panicum*, nandi (*Setaria sphacelate* Schumach), and kikuyu grass (*Pennisetum clandestinum* ex Chiov) (although the last two types of grasses were not part of the Grass2Cash technology package)–while the men mentioned growing only the first three.

3.3.2 | Access to forage planting materials (seeds and splits) in Kenya

Farmer access to forage seeds in Kenya seemed to be closely related to membership in a farmer group. Being a member of a farmer group offered additional opportunities for interactions with government and nongovernmental agencies under the Grass2Cash project. Women were more likely than men to be consistent members of farmer groups and hence were most likely to be the first household members to access new forage planting materials in their communities. Women SSGI participants shared that it was uncommon for men to access forage planting materials through farmer groups.

> It's not easy for men to source the new varieties because men are not social and therefore not in groups. They also find it hard to request new varieties from their neighbors. It's easy for women to source these because they go to groups. Many organizations work with farmer groups who get trained and go for tours to learn and get new things, including seeds.—Kenyan woman respondent, Bungoma, 2020.

A few women reported that it was their husbands who had obtained the forage planting material, brought it home, and guided them on how to plant and manage it.

Men reported mostly "buying" their forage seeds or obtaining forage splits from dairy cooperative offices or as gifts from other farmers. A few men reported being members of farmer groups or receiving forage planting materials by attending field days carried out at the host research farmer fields.

The on-farm research demonstration plots (mother trials) and the accompanying field days were identified as "key" for all farmers to access both knowledge (where men and women farmers were able to "see" and "assess" for themselves the traits and characteristics of different types of forage plants) and planting materials (splits for planting on their farms).

> I heard about the grasses during a CIAT field day hosted by a farmer group, where I heard that the grasses grow fast, are resistant to diseases, are palatable to the dairy animals and have higher nutrients than napier. I heard this from group members who had received the seeds and were trained by the peer farmer trainers.—Kenyan woman respondent, Bungoma, 2020.

Visits by new forage farmers to regions where farmers had learned to grow and use the new forages and had experienced the "livelihood benefits" were effective ways of communicating to new farmers and increasing adoption of the improved forages. One woman who had travelled to visit another farmer group in Kakamega said she saw the improved forage varieties there for the first time and heard stories of their effect, which incentivized her to invest in improved forages. Another woman after such a trip said she invested Ksh30,000 (US$300) in forage planting material and was also motivated to buy an improved dairy heifer.

3.3.3 | Challenges in testing the improved forages on the Kenyan farms

The Kenyan women participants spoke of their challenges in growing improved forages. Among the greatest was *limited land access for forage production and expansion*. After testing the improved forages for 2 yr, these women identified opportunities for growing *Brachiaria* grasses not only to feed their livestock but also to sell for profit. But the women claimed that their farmland was too small for forage production and expansion. They found it hard to convince their husbands to allocate more land to forages as most of the land was allocated to growing maize (*Zea mays* L.) and other food crops. Some of the women used the income they generated from their small forage plots to negotiate with their husbands for more land to establish forages. They argued that forages have higher benefits than food crops, as forages serve dual purposes as both a cash crop and dairy fodder.

Speaking of their challenges in growing improved forages, most of the Kenyan men mentioned *limited access to forage planting materials (seeds, cuttings, and splits)*. Because development agencies often use farmer groups to distribute forage planting material to communities and because men seldom participate in farmer groups, they did not easily access planting materials distributed by CIAT/SACK through well-organized women's groups and cooperative societies. A few men further noted that women get the seeds and propagation materials from their group members under the *passing-on-a-gift* principle. The men also mentioned *limited access to information on forage establishment and management* as a problem for them. Not being members of social groups means they lose out on training and demonstration sessions on how to establish and manage forages. Some men also complained about the *low survival of splits due to lack of knowledge*, saying that most of the splits they get from *passing-on-a-gift* wither during transplanting. Finally, the men mentioned *the poor quality of purchased forage seed* that they tend to buy from markets and agro-vets (unlike co-op members who buy through their co-ops) and a few men who purchased seeds complained of their low germination rates.

3.3.4 | Gender differences in forage preferences in Kenya

The SSGI respondents were asked to reflect on their experiences with the forages in the mother trials (learning platform) and identify traits that they considered important or good when considering a forage for adoption from a baby trial (into their farms). Out of the positive traits, they were asked to identify the top three in order of priority. They were also asked to identify other important traits, traits they disliked, and finally, "the worst" trait for them (which did not emerge from the Kenya interviews). The results of the Kenyan SSGI are in Table 4.

Both male and female Kenyan farmers said that the forage traits they valued most highly were high yields and palatability, good nutrition, and drought tolerance (Figure 2), with more women valuing high yields and drought tolerance than the men. Nutritious forages were reported to increase the amount and quality of milk cows produced and to improve the body condition of cows. When different forage types and varieties were mixed up in the feed, farmers found it difficult to tease out specific beneficial traits in specific forage varieties. However, some farmers still noted an overall benefit (or not) of fodder combinations to their cows' health and milk production.

> I have planted Cayman, Cobra, Maasai, Tanzania and Kikuyu grass and I like all of them because of the effects of the grasses on my animal, which is now healthy and has shiny skin. The milk production is high; the grasses are all fast growers. I cannot tell which among the grasses contributes to the increase in milk because I cut and mix all the varieties and feed them to my dairy animals.—Kenyan woman respondent, Bungoma, 2020.

This qualitative information is corroborated by the quantitative RHoMIS data as seen in Figure 2. One trait, faster growth, was not scored highly at the RHoMIS baseline, but during the SSGI interviews, it was emphasized as being a key trait.

3.3.5 | Emerging fodder market in Kenya

Amounts of fodder sold in Kenya's emerging fodder markets tend to be relatively small and measured in "loads" that a man or woman can carry on their backs or heads or in wheelbarrows or "cartloads" drawn by draught animals. The price per load of forages tends to be low and is often negotiated daily around the forage plot. These characteristics—small amounts, low prices, frequent sales—are unattractive to Kenyan men, who would prefer large, infrequent sales that bring in lots of money. Forage sales in Kenya therefore tend to remain in the control of rural women, with the income generated in fodder sales offering a rare pathway for women's economic empowerment.

TABLE 4 Trait preferences for forage crops, by men and women in Kenya, based on semistructured group interview

Trait preferences	Men	Women
Top three priority traits as ranked by respondents	1. Good nutritious biomass leading to increased milk production	1. Germination and splits establishment rate
	2. Fast regrowth–adequate biomass for a given unit of land	2. Drought resistant–surviving dry spells without drying off
	3. Palatability–no wastage when fed to animals	3. Resistance to diseases (ranked same as "resistance to drought")
Other forage traits considered positively by respondents	Drought resistant–surviving dry spells without drying off	Easy to harvest (children can help in harvesting without injuring themselves)
	Not easily infested by pests	Good nutritious biomass that leads to increased milk production
		Good nutritious biomass that leads to cows coming on heat at good intervals
		Palatable–cattle eat it without wasting much
		Smothers weeds so farmers do not have to weed the forage plots
		Fast regrowth in dry as well as wet seasons
		Mode of planting successful with splits
		Long productive life span, preferably >15 yr
		Marketable fodder products that local buyers prefer because of they are nutritious
"Bad traits" in a forage	Easily infested by pests	Easily infested by pests
	Easily attacked by diseases	Easily attacked by diseases
	Regrows slowly from one cutting to the next	Regrows slowly from one cutting to the next
	Unpalatable, leading to wastage	Unpalatable, leading to wastage
	Low biomass per unit of land	Not drought resistant–drying off during the dry spells
		Causes diarrhea in cows if harvested early
		Low germination rates

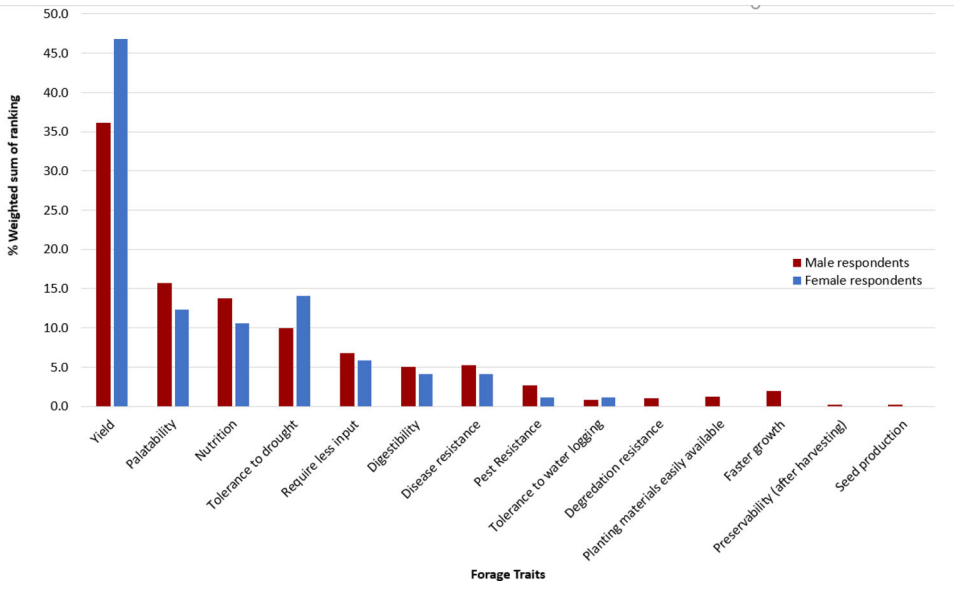

FIGURE 2 Fodder trait preferences of male and female farmers in Kenya

3.3.6 | Changes to household income generation in Kenya

All SSGI respondents reported that feeding cattle on the improved forages led to increased milk yields. From the sales of extra forages and surplus milk, both women and men reported earning more disposable incomes. The Kenya respondents reported using their new income to educate their children, pay medical bills, pay for veterinary services, and construct cattle pens. A few reported using their new income from forage sales to improve their household hygiene by building better toilets and bathrooms. Some men reported using these earnings to acquire mobile phones, with which they then saved their extra income through mobile banking.

Kenyan men talked positively about the benefits the improved forages brought to their spouses' wellbeing. Some men reported that their spouses had used their forage sale incomes to start poultry, rabbit, sheep, goat, and vegetable farming and that the women were in control of the income from these enterprises. This was confirmed by the women. Most of the discussants in the men-only SSGIs in Kenya claimed that the greater income under women's control had reduced not only their spouses' dependency on them but also the perpetual conflicts resulting from their wives' frustrations over low household incomes, but not always with the desired benefits.

> Women are becoming arrogant and disrespectful to their husbands once they receive income from the sale of the forage. This annoys their husbands, who refuse to give them more land to expand their forage production.—Kenyan woman respondent, Bungoma, 2020

Women in SSGIs reported taking advantage of their increased incomes to hire casual laborers to support them in their farming work. They also said that the increase in disposable income under their control enabled them to engage actively in communal social groupings, where they saved part of their income.

> I'm harvesting 12 litres of milk a day, which I sell for Ksh50 [..a litre…]at the farm gate. From the proceeds, I have increased my shares […money contribution amount per month…] in the […women's savings and loan…] group, which stand at Ksh200 a day, and I have also bought a local goat from the proceeds.—Kenyan woman respondent, Bungoma, 2020

The women said the availability of forages enabled them to keep dairy cattle, from which they get manure as well as milk. They use the manure to fertilize their crop soils, which boosts their yields of grain and vegetables for home consumption, or they can sell the manure to their neighboring farmers.

3.3.7 | Changes in women's participation in household decision-making in Kenya

Kenyan men SSGI participants claimed to have started engaging their spouses in decisions such as allocating land to different crops, selecting cattle for breeding and sales, selecting improved forages, and deciding how to spend their new incomes. The Kenyan women respondents attributed these changes in intra-household decision-making mostly to the Grass2Cash project's training on critical 'cornerstones', specifically on the pillar on "gender and family focus". The women said that they had gained greater respect and trust from their husbands when they attended the project training together. As a result, they said they now oversee bargaining during sales of improved forages and decide with their husbands how to spend the revenues that this work generates.

> I can proudly confirm that the greatest change is that my husband now trusts me with the forage sales, and when a buyer comes, he usually calls me to bargain for the best price. We can now even discuss as a couple how to utilize the proceeds from forage sales.—Kenyan woman respondent, Bungoma, 2020

A few men in Kenya reported that the women's new decision-making roles had increased the women's interest in managing the improved forages.

> I decided to establish forage grass in a small trial plot and tended it well to convince my wife that I earned Seven dollars in less than three months, which I gave to my wife to use and explained the source. From then, she is a changed woman; we discuss and support each other and have since expanded our forage acreage to a quarter of an acre.—Kenyan man, Bungoma, 2020

3.3.8 | Changes to men, women and children's time use and labor burdens in Kenya

The Kenyan men and women reported that adopting the improved forages had reduced the family labor needed to manage the cattle for all household members: men, women, and especially children. Before planting the improved forages, the

men said that they used to spend most of the day grazing their local animals, which still failed to get enough grass of adequate quality. The women reported that the burden of better feeding cross-bred cattle—their responsibility mostly—has been reduced also, since the improved forages were planted near their homestead, making it easy to cut and carry forage grass to their cows. Some women added that the hired casual laborers contributed to this work, also. Although having the forages planted close to the homestead saved time, some women reported that their workloads had increased because they had to grow enough forages to feed their livestock and sell for income.

3.4 | Results from the SSGI in Ethiopia

3.4.1 | Characteristics of the Ethiopian households

A total of 46 respondents were interviewed in the SSGIs of 24 males and 22 females. The age of the SSGI respondents ranged from 41 to 50 yr and the women were younger than the men on average. This is within the range of the age of farmers in the study area as observed from the RhoMIS dataset (i.e., 45–60 yr of age). Ethiopian farmers had significantly lower education levels compared to their Kenyan counterparts. Similarly, Ethiopian female farmers had significantly lower number of years of education compared to the men. The mean household size was five persons, and the average area of cultivated land was 0.61 ha (1.5 acres). (Table 2). See detailed analysis of the RHoMIS survey in (Waweru & Paul, 2021).

3.4.2 | Cattle owned by the Ethiopian households

About 92% of the Ethiopian households kept cattle (Table 3). Of the cattle-keeping households, most (91%) kept only local (unimproved) cattle. Of these Ethiopian households, 78% recorded female ownership of livestock (either singly or jointly with male household members). More Ethiopian than Kenyan households had women participating (singly or jointly with male household members) in making decisions about cattle, such as how much of the milk the household should consume and how to spend the income from sales of milk and livestock, because social norms in this part of Ethiopia guide that management of milk is a women's responsibility. Unlike their Kenyan counterparts, Ethiopian households kept higher numbers of castrates (steers) and fewer cows. No significant difference was observed in herd structure by gender of the household head.

3.4.3 | Land allocated to forages by the Ethiopian respondents

From the SSGI participants, land allocated to forages in Ethiopia was 0.22 ha for the men and just 0.01 ha for the women. Women reported planting forages on contour lines around food crop fields as a way of conserving soil and water, which increased their yields of food crops grown. The Send-a-Cow team in Ethiopia set a target for each farmer to dedicate at least 100 m^2 to the forages. To scale out production, some women mentioned plans to use communal lands if their farms were not large enough.

3.4.4 | Types of forages grown in Ethiopia

In Ethiopia, about a third (34%) of households reported gathering forages in the dry season and a little more than a third (38%) reported cultivating forages in the wet season (Table 2). Participant women reported growing three types of forages, men two types, on average. All SSGI participants had grown at least one type of forage (see Figure 1). They reported growing *Brachiaria*, napier and desho, with buffalo grass [*Brachiaria mutica* (Forssk.) Stapf] being more common than the other *Brachiaria decumbens* varieties (Cayman, Cobra, Basilisk, Piata).

3.5 | Access to forage planting materials (seeds and splits) in Ethiopia

Forage planting material in Ethiopia was accessed through ILRI's Herbage Seed Unit and distributed via self-help groups by the project's implementing partner Send-a-Cow Ethiopia (SACE). Both men and women farmers mentioned that once farmers qualified in meeting the membership criteria of these self-help groups (ownership of land and cattle, ability to manage the forage plots, and pass on forage splits), they all had the same opportunity to access forage splits. Yet, contrary to Kenya, more Ethiopian men than women seemed to have easier access to forage splits, which they sourced through government extension agents and SACE groups.

The women said they had been constrained in accessing improved forage seeds and splits before the Grass2Cash project because government extension agents mostly distributed forage planting materials to men farmers only. With the Grass2Cash project, only the women who became members of the self-help groups could access the improved forage varieties directly, but they shared with their friends and neighbors.

TABLE 5 Trait preferences for forage crops, by men and women in Ethiopia, based on semistructured group interview

Trait preferences	Men	Women
Top three priority traits for forages as ranked by respondents	1. Fast regrowth in the dry as well as wet seasons	1. Nutritious biomass
	2. Drought resistant–surviving dry spells without drying off	2. Conserving soil and water
	3. Conserving soil and water	3. Fast regrowth in the dry as well as wet seasons
Other forage traits considered good	A lot of biomass produced in a small area	Drought resistant–surviving dry spells without drying off
	Nutritious biomass	
	Capacity to reclaim land when planted on degraded lands	
	Leads to thick and good-quality "Arera" milk[a] after processing of butter	
Bad traits in a forage	Becomes hard if not harvested on time (difficult to harvest, animals cannot eat)	Slow regrowth from one cutting to the next
	Splits taking too long to establish	Not drought resistant—dries off during dry spells
	Yellowing during the dry seasons	Easily infested by pests
	Requires high levels of inputs (manure, fertilizer)	Easily affected by diseases
	Competes for soil nutrients when grown on contours, reducing yields of food crops	Requires high levels of inputs (manure, fertilizer)
	Low biomass per unit of land	Low biomass per unit of land
Worst traits	Competes for soil nutrients when grown on contours, reducing yields of food crops	

[a]"Arera" milk is Ethiopian sour skimmed milk.

3.6 | Challenges in testing improved forages on the Ethiopian farms

Both men and women respondents mentioned that *limited access to information about improved forage availability* was a key constraint faced by women farmers. They explained that government extension staff usually announced when they would next distribute forage seeds using megaphones in public spaces and so this information usually failed to reach women, who tended to be at home, handling domestic chores. The field reports did not mention any specific challenges faced by the men. However, being members of the Grass2Cash project, women could easily get information about improved forages

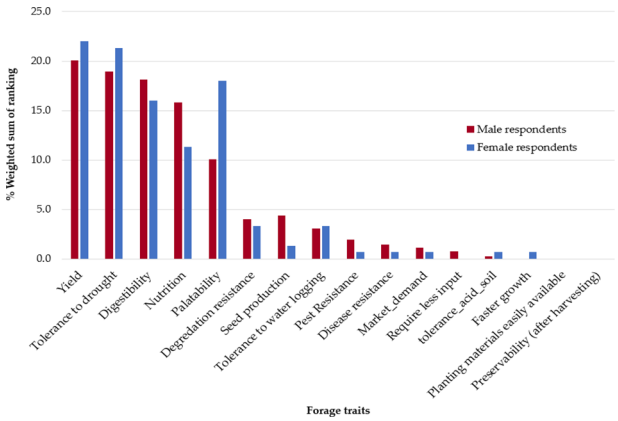

FIGURE 3 Fodder trait preferences of Ethiopian men and women farmers

3.7 | Gender differences in forage preferences in Ethiopia

Gender differences in forage preferences in Ethiopia are presented in Table 5.

The Ethiopian farmers sought forage high yield, drought tolerance, digestibility, nutrition, and palatability more than other forage attributes (Figure 3). High yield and drought tolerance were found to be the most important traits among both male and female respondents, with more women than men saying that they valued high yield, drought tolerance, and palatability.

Fast regrowth was identified as a key preferred fodder trait by both men (as number 1) and women (number 3) in

the SSGIs. This differed from the baseline data collected about forage traits, in which only a few women, and no men, had ranked fast regrowth as an important trait (Figure 3). Similarly, preservability, seed production, and fast regrowth were traits that were mentioned only during the SSGIs.

3.8 | Emerging fodder market in Ethiopia

The introduced fodders were not reported to have emerged as a traded commodity in Ethiopia. Maybe because the plots of land planted to the improved forages were very small (0.01 ha on average that the men and women had planted from the Grass2Cash activities) and the household cattle herds much bigger than in Kenya, most of the fodder harvest in Ethiopia was used within the households, without much remaining to sell. In addition, there were no reports from the SSGI of either male or female farmers who did not own livestock growing fodder as a commercial crop in Ethiopia.

3.9 | Changes to household income generation in Ethiopia

Both men and women Ethiopian respondents reported that feeding cattle the improved forages increased their milk yields and disposable incomes, which they used to educate their children, pay medical bills, pay for veterinary services, and construct cattle pens. Both women and men reported increased income from fattened animals and sales of surplus milk and milk-processed products. They explained that their cows' lactation periods had increased, which made more milk available for feeding to the calves or their families. The Ethiopian men noted fewer deaths of calves, which they presumed was due to the greater amounts of milk the calves were ingesting, and of cattle, due to the availability of forages to feed their cattle during the frequent droughts that occurred in their region. Men claimed that the better-fed cattle were stronger and could plow larger fields than other cattle. One woman reported having started a business fattening and selling bulls. Some women used their new income to pay for casual laborers to assist them in their farm work, thereby reducing their workloads. The women said they were participating more in communal social savings platforms while the men said they were investing in cattle fattening businesses due to the availability of nutritious forages.

> I bought an ox at the cost of 8,000 Ethiopian birr and resold it for ETB13,000 after feeding it on highly nutritious desho grass for three months, making a profit of ETB5000.—Ethiopian man, Soddo Zuria, 2020

3.10 | Changes in women's participation in household decision-making in Ethiopia

In Ethiopia, social norms dictate that milk belongs to women and they can make all decisions relating to milking and the processing and selling of milk products. However, it is also accepted that dairy cows belong to men and only they can make decisions about selling the animals or using the incomes they generate. This latter custom appeared to be changing, however, as some Ethiopian men reported to have started engaging their wives in making decisions regarding such things as allocating land to different crops, selecting cattle for breeding and sales or improved forages to plant, and how to spend the income generated by these activities.

> Almost all decisions related to dairy management are now made jointly by husbands and wives. In my case, I search for the market for milk, but my wife sells the milk. I collect the money from the milk sales, but we manage that income together. In the past, before we received training from this project on the 'family' pillar, decisions relating to what to do with the income earned, what to sell and buy, used to be made only by the husband.—Ethiopian man, Soddo Zuria, 2020

While sales of milk and milk-processed products continue to be managed by women, the Ethiopian women respondents confirmed that the changes in intra-household decision-making could be attributed to the Grass2Cash project's training in the pillar on "gender and family focus".

> Now, women and men jointly decide what animal to sell, to buy and what to use the money for. In the past, it was only the husband that decided what animal to sell, and he managed all the income from the sale. Due to this project's gender-related training, this is now changed.—Ethiopian woman, Soddo Zuria, 2020

3.11 | Changes to men, women, and children's time use and labor burdens in Ethiopia

Both Ethiopian men and women reported that adopting this project's improved forages had reduced the labor required to manage the household cattle, especially for women. The women said that the improved forages were grown close to the homestead and only a small amount of this fodder

was needed to feed the cattle each day. Also, their husbands and children were actively supporting them in daily cutting and carrying the fodder to feed the cattle. They explained that before the Grass2Cash training, it was women alone who did most of the dairy management work. A few of the Ethiopian men explained that the project's "cornerstone" training had changed the social norm that "only women can manage a dairy animal" and that, as a consequence, men were beginning to involve themselves in feeding the household cows.

4 | DISCUSSION

The participatory co-learning design used in this Grass2Cash project gave the participating Kenyan and Ethiopian fodder farmers opportunities to access and evaluate improved forage varieties. This methodology has remained effective for two decades, since Snapp (1999) first documented the mother–baby trial use in disseminating agricultural technologies. Yet, gender differences emerge from the findings in terms of preferences, access, and benefits associated with the new varieties.

In terms of trait preferences, Ethiopian women and men mostly agreed on the top three forage traits they preferred although they ranked them differently. The number and type of negative traits mentioned by both women and men were similar and focused on plant survival. The highest-priority trait in forages for Ethiopian women was their effect on milk quantity and quality. Interestingly, while "first regrowth" was a trait identified by women as among the least important at the beginning of the project (Paul, Tigabie, et al., 2019) it climbed the ranks to become the trait considered most important by both men and women in 2020. We surmise that the ability of farmers to test the performance of a forage variety under their farm conditions allows them to understand better the characteristics of the forage, which then influences, and modifies their trait preferences.

Kenya women and men, in contrast, mostly differed in their top three traits, with the men favoring traits that improved animal nutrition and the women favoring plant survival. This difference is possibly due to the fact that women generally are the ones in charge of obtaining and then planting forage splits, while the men are in charge of animal sales (and better fed animals sell better). Kenyan women also prioritized traits that enhanced ease in harvesting possibly to help with the weeding work necessary before the forage plants are well established, and because children and others are more able to help with harvesting when that work is unlikely to injure them (see also Megersa, 2020). These findings show the importance of forage-breeding programs to facilitate variety assessment by both women and men who may have different preferences for traits and their prioritization.

Kenyan men and Ethiopian women said that their lack of access to improved forage seed and information remained the main constraints to their adoption of the improved forage varieties. Groups were an effective means to disseminate varieties to women in Kenya. On the few occasions that the Kenyan men sourced forage planting material, they purchased the material from shops rather than obtaining it from farmer groups. Interestingly, however, Kenyan men mentioned planting more forage crops than the women. This may be because the men have more resources, money, land, and labor than women and thus can afford to trial more varieties. In Ethiopia, women had more difficulty in accessing forage varieties than men because of the very public way government officials announced new distributions of forage splits. The women said that SACE groups provided more equitable access to the improved forage planting material as compared to the public system. Therefore, groups emerge as an important channel to disseminate improved varieties and information. However, group membership requirements such as ownership of land and dairy animals are likely to lead to exclusion of the poorest male and female farmers, as noted by the participants.

The economic potential of accessing improved varieties, particularly for women, emerged in Kenya. The Kenyan women who had accessed the improved varieties, mentioned, as the main constraint they faced, an inability to convince men to grow more forage. Women's interest in expanding the forage cultivation can be explained by the fact that these women saw the market potential of selling: the surplus fodder (available with the new varieties), the surplus milk (available with better fed animals), the manure (available with increased forage quantities), and the surplus crops (fertilized with the manure). These constituted unique marketing opportunities for women who are generally excluded from the marketing node of agricultural value chains.

Our findings also highlight gendered use of the new income generated through the improved forages. The Kenyan men invested the new money in mobile phones and digital banking. The Kenyan men, on the other hand, used this income to "move up the livestock ladder" and build their own asset base, by acquiring more valuable livestock species (Galiè, unpublished data, 2021).

Women, largely lacking access to banking services, tend to invest their savings by accumulating more or higher value animals (Njuki & Sanginga, 2013). Alternatively, women in Ethiopia, as well as Kenya, relied on women's social groups to save their money. Social groups emerged from the SSGIs as not only central to women's access to improved forages and information, but also important as saving schemes.

What is noticeable here is that the income from these new market opportunities stayed under the control of women. In other studies, when small-scale agricultural enterprises grew to become profitable, men tended to take up active roles in

the value chain, displacing women and excluding them from enjoying the benefits of their work (Mwaseba et al., 2015; Nyabaro et al., 2019; Tavenner et al., 2018). But men in the Grass2Cash project reported being happy that their wives were generating new income. The women's ability to keep control over the forage marketing and benefits may be due to its small scale of operations, which are largely informal, with transactions being negotiated along social networks and mostly women-to-women and men-to-men, thus obviating the need for formal collateral or registration. Furthermore, the fodder money is generated in small amounts (with each fodder cut) over a long time period. These characteristics mirror the rural poultry and other value chains that rural farming women are able to participate and thrive in (Ogunlade & Adebayo, 2009). We recommend tracking the growth of the improved forages value chains and the factors that will contribute to them continuing to be beneficial to women's empowerment.

This indeterminant result begs the question as to just how much these farming women will be able to "thrive" before their enterprises are taken over by business-minded men, and thus to what extent planted forages can become "pathways for women's empowerment"? This project did uncover a few negative repercussions of the intervention, such as when a woman argued that when money is in the hands of a woman, the woman becomes disrespectful of her husband's authority and her husband then responds by withholding land for expansion of the forage fields.

Women SSGI participants, in Kenya and Ethiopia, reported being involved more in household decision-making than before their participation in the project. Participation in farmer groups and attending training sessions, were said by women participants to increase their husband's trust towards them on crop and income management. Also, men participants said that participating in this project's "gender and family focus" cornerstone training, made them change their attitudes towards social norms that discouraged them from helping women in taking care of dairy cows (in Ethiopia) and involving women in decision-making (both Kenya and Ethiopia). Interventions to increase the adoption of improved forages coupled with gender equity trainings may indicate a way for rural women in dairy households to empower themselves while raising the income and well-being of the whole household and also a way for projects to progress towards gender equity in their outputs.

Men and women participants indicated that the introduction and adoption of improved forages led to net time savings for men, women, and children in the cattle-rearing households in the study sites, corroborating the findings of (Megersa, 2020) for men in Kiore villages in Kenya. However, in those villages, some women indicated that their workloads (as well as those of the girls) only increased as they took over the job of cutting forages to feed the household cattle from the men, who had stopped taking cattle out to graze.

Interestingly, the interview responses in this study indicated a number of shifts in the gender division of labor and time use related to the new forage practices. Local breeds entailed that men and boys spent much time grazing the cattle, but improved cattle breeds were kept at home and fed better. Women were tending to take over much of the time-consuming feeds harvesting of improved forage varieties, which were cultivated close to the homestead, and so considered easier: they needed to carry less weight and over shorter distances. Also, men and boys started to help carry the forage. As improved forages became marketable, women started to invest more time and labor in growing the forage crops. With the adoption of new forage varieties, women and girls perform more tasks needed to manage the cattle, which may cancel their time gains. Some women reported, however, that they used the income generated from forages to hire labor to support the tasks, which gave them more time to invest in household chores, childcare, and community activities. This study did not analyze in detail these complex shifts in the labor of men, women, boys, and girls in the small-scale cattle-rearing households, but it highlights the need to do so.

Work–leisure time balance, decision-making, control over income, group participation, and control over agricultural labor are key domains of women's empowerment among livestock communities (Galiè et al., 2019), thereby showing the empowerment potential of the Grass2Cash project in Kenya and Ethiopia where women have good access to the improved varieties. Further research is needed to assess quantitatively if such benefits accrue to only the project participants or to the general community and whether the gains are sustained after the project implementation period and also, to assess the circumstances under which such potential can be maintained.

5 | CONCLUSIONS

This paper presents the results of a gender study, done as a component of a bigger project, that aimed at introducing improved forages to communities in western Kenya and southern Ethiopia. Investigating the gender dynamics around the introductions of improved forages among selected farmers in Kenya and Ethiopia led to insights that demonstrate clear benefits for both men and women farmers. Strategically combining the technical knowledge, improving access to forage planting materials (splits and seeds) with gender sensitivity training led to a set of outcomes that included availability of high-quality forages for the animals, improved livestock raising and milk availability in the household, and increased income through the sale of surplus milk and marketable forages. It did so by successfully reaching and benefiting women. The introduction of improved forages to farmer groups, coupled with the cornerstone principles that include gender sensitivity dialogues has led to positive changes in gender

relations among the participating households. The project also led to shifts in social relations that allowed women's participation in decision making while men in Ethiopia, where norms constrain their participation, were now taking on livestock-care roles that only women did before. Furthermore, women empowered by new knowledge, skills, and forage varieties and practices have worked with men to produce more and higher quality household fodder that has led to healthier livestock herds; more milk, manure, and meat; and higher household incomes in the project sites in Kenya and Ethiopia. However, the benefits are demonstrated among the project participants, men and women, and not necessarily in the general population. The project time frame is too short also to clearly show if the gains attained are long lasting and will be sustainable past the life of the project. Combining technical innovations and gender sensitive innovations is an approach we would recommend for forage introductions specifically and any other innovations introductions in general. Future research needs to establish how larger parcels of land can be grown under forages and by more farmers.

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Esther Njuguna-Mungai: Data curation, Formal analysis, Validation, Writing-original draft, Writing-review & editing, Immaculate Omondi:Data curation, Formal analysis, Methodology, Writing-review & editing, Alessandra Galiè: Conceptualization, Data curation, Formal analysis, Methodology, Writing-review & editing, Humphrey Jumba: Conceptualization, Data curation, Formal analysis, Writing-review & editing, Melkamu Derseh: Investigation, Validation, Writing-review & editing, Birthe K. Paul: Conceptualization, Data curation, Methodology, Writing-review & editing, Mesfin Zenebe: Investigation, Methodology, Project administration, Alfred Juma: Investigation, Methodology, Project administration, Alan Duncan: Conceptualization, Funding acquisition, Investigation, Project administration, Supervision, Writing-review & editing.

CONFLICT OF INTEREST

The authors declare no conflict of interest.

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