

Gender dynamics and social implications of improved planted forages in smallholder dairy systems in Kenya

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I Summary

Forage technologies have successfully been introduced into smallholder cattle systems in Kenya as an alternative feed source to the use of crop residues and natural pastures, improving animal nutrition and reducing the labour requirements for feeding cattle.

The major constraints of introducing forages, especially legumes, into smallholder and pastoral systems are that they are demanded only in special circumstances. Previous research has highlighted the positive impacts of forage technologies, including increased dry matter yields and growth rates of cattle. However, further research was required to understand the gender and social-economic implications of introducing planted forage that might accelerate its incorporation into the current livestock production systems in Kenya. A survey of households that grow forage (n = 111) in November 2018 examined the gender dynamics and social implications of introducing planted forages into smallholder dairy systems in Kenya. Time savings were reported as the main driver of forage adoption, with both women and men having 1–2.5 hours of free time each day, which they used differently. All the farmers reported using the saved time to engage in social-economic activities. In addition, men used the saved time to engage in business activities. All participant farmers reported noticing an increase in milk production since they began to feed planted forages. Farmers growing fodder also reported an opportunity to sell excess fodder and earn income. The lack of baling machinery was reported as the main challenge to this activity. Currently, opportunities exist for households that produce excess fodder to better utilize forages through conservation strategies, although assistance is required to support these households with information and training on these strategies. It was reported that as a result of women getting involved in fodder management training, they were not only taking up more roles in fodder and dairy production but also had more control over income from milk and fodder sales. Both men and women farmers reported the increased participation of women in decision-making about forage production in terms of where and when to plant forages, the size of land to commit to forages and how many cattle to keep, amongst others. However, stronger and reserved rights over land use by men may limit women's ability to express such rights in the context of improved forage adoption. A small number of women and men farmers reported that other activities related to forage production and use increased the labour burden for forage adopters. In particular, men reported increased labour in manually harvesting, transporting and chopping fodder. Women's added roles in forage production activities, coupled with their productive and reproductive roles, suggest the adoption of improved forage may increase the labour burden on women. This presents opportunities for introducing forage processing equipment to reduce the drudgery involved in chopping fodder manually and improving utilization.

2 Introduction

Livestock is an important part of smallholder livelihoods in mixed crop/livestock systems in East Africa as they are a source of regular income for smallholder farmers through the sale of livestock products (milk, meat, manure, hides and skins) and hence provide incomes and other livelihood opportunities. In sub-Saharan Africa, cultural norms strongly determine men's and women's roles related to livestock since they traditionally have different responsibilities related to livestock production and derive different benefits (Kristjanson et al. 2010). Livestock productivity improvements can enhance the well-being of smallholder dairy farmers but the benefits to household members and the degree and type of investments (time, labour, financial) each contributes may differ between household members. Hence, gender considerations relating to access to and control over assets play a major role in determining how income does or does not translate into welfare (Meinzen-Dick et al. 2011). Women may not have an incentive to invest in productivity improvements if they are not compensated for additional investments and beyond current demands (Kristjanson et al. 2010; Quisumbing et al. 2015).

Planted forages have the potential to transform livestock productivity. The majority of farmers experience feed scarcity in the dry season, with farmers relying extensively on crop residues, collected feed, roadside grazing or purchasing off-farm produced feeds. Extreme seasonality effects aggravate the situation and result in seasonal feed shortages when animals are usually underfed, resulting in a sharp decline in livestock productivity. Planted forages, both grasses and legumes, have the potential to provide the high-quality nutrients required by livestock animals. Several efforts have been made by different projects to introduce improved forages to smallholder farmers in western Kenya over the past decade. However, smallholder farmers have not embraced growing forages as fast as it was envisaged due to many reasons, including the lack of forage seed.

The purpose of this study was to analyse the gender dynamics and social implications associated with the introduction of improved planted forages in dairy systems in Kenya. The topics explored included forage production and use, constraints and opportunities of forage production, land and labour allocation, men and women's roles and responsibilities, gender roles in decisions on forages and adoption of forage technologies made at the community level.

3 Methods and procedure

This study used focus group discussions (FGDs) to collect qualitative data from Migori, Vihiga and Siaya districts in western Kenya in 2018. This method obtained data from nine gender-separated FGDs – six of them with men and women separately and three of them with mixed men and women. The survey took place in the Accelerated Value Chain Development (AVCD) dairy project sites in Kenya.

The AVCD dairy project introduced three cultivars of *Brachiaria* species to more than 3,000 farmers in the western region of Kenya. These species were *Urochloa Brizantha* cv *Xaraés*, *Urochloa decumbens* cv *Basilisk* and *Urochloa brizantha* cv *Piatã*. However, farmers were also planting other types of forages (see Table 1). Before the introduction of the new forage species, farmers reported planting other types of fodder, including improved *Brachiaria* cv *Mulato I* and *II* hybrids developed by the International Center for Tropical Agriculture (CIAT), ‘Greenleaf’ desmodium (*Desmodium intortum*), ‘Silverleaf’ desmodium (*Desmodium uncinatum*) and different ‘Napier grass’ (*Cenchrus purpureus*) varieties, e.g. Kakamega I and II, Bana grass, Ouma I and II and South Africa.

The locations for this study were purposively chosen from amongst the project sites for the AVCD dairy project. The farmers selected for the focus group discussions (FGDs) received forage seeds or vegetative planting materials, planted forages and were using forages. In addition to receiving planting materials, these farmers were trained on improved forage establishment, management and use. The FGD respondents were selected with the help of project field staff and village focus persons. Between 10 and 15 men and/or women of different age groups participated in each FGD (Table 2). Discussions were conducted in Kimaragoli in Vihiga district, Dholuo in Rongo and Siaya districts, as well as in Kiswahili and/or English in all districts.

The FGDs were conducted using a checklist to gain an in-depth understanding of gender issues in forage production and use. The study investigated the labour burden and implications of adopting planted forages on men, women, youth and children. Their involvement in dairy feeding in general was investigated, as well as the constraints and opportunities for women and men to engage in forage production, its use and sale, the perceived benefits and the effects of planting improved forages on the current roles and responsibilities of men and women. Each FGD session lasted for about two and half hours and was held in a community setting selected for the convenience of the respondents. A female and male facilitator led the female and male discussions respectively. There was joint facilitation of female and male-led discussions of the joint FGDs. Before each session, a consent form seeking permission for the interviews from farmers was read to them in the local language. Farmers signed the consent forms before the FGDs commenced. Each FGD had a scribe to keep a record of the proceedings and to record the sessions and a timekeeper to guide time-keeping. Subsequently, the notes were transcribed into English in Microsoft Word. The responses and comments from each FGD were then organized into spreadsheets following the guiding questions and modules to enable cross-group (gender) and cross-district comparison. Data were analysed using NVivo 10 for Windows.

Table 1: Types and sources of planting material for forages grown by farmers in the study sites.

District	Group name	Forage variety	Source of seeds or planting materials
Migori	Rongo Dairy Farmers Cooperative Society	Brachiaria Brizantha cv Xaraés	International Livestock Research Institute (ILRI)*
		Brachiaria decumbens cv Basilisk	ILRI*
		Brachiaria brizantha cv Piatã	ILRI*
		Desmodium green leaf and silver leaf	ILRI and International Centre of Insect Physiology and Ecology (ICIPE)
		Brachiaria mulato I and II	ICIPE, The International Center for Tropical Agriculture (CIAT)*
Siaya	Siaya East Coast women's group	Brachiaria Brizantha cv Xaraés	ILRI*
		Brachiaria decumbens cv Basilisk	ILRI*
		Brachiaria brizantha cv Piatã	ILRI*
		Napier grass – var Kakamega I and II	ILRI
		Desmodium green leaf and silver leaf	ILRI
		Napier grass – var South Africa and Ouma I and II	ICIPE
		Boma Rhodes	Farm Input Promotions Africa Ltd. (FIPS) through AVCD project
		Brachiaria mulato I and II	ICIPE, CIAT
Vihiga	Imanda women's group	Brachiaria Brizantha cv Xaraés	ILRI*
		Brachiaria decumbens cv Basilisk	ILRI*
		Brachiaria brizantha cv Piatã	ILRI*
		Napier grass – var Kakamega I and II	ILRI, Heifer International and FIPS
		Desmodium green leaf and silver leaf	ILRI
		Brachiaria mulato I and II	ICIPE, CIAT
		Boma Rhodes	Eastern Africa Agricultural Productivity Project (EAAPP)
		Calliandra calothyrsus	Eastern Africa Agricultural Productivity Project (EAAPP)

Source: FGDs, men and women, Kenya, December 2018

Note: Varieties with * are not a released variety in Kenya and only allowed to be planted for research purposes

Table 2: List of dairy cooperatives and attendance by gender.

District	Group name	Men	Women
Migori	Rongo Dairy Farmers Cooperative Society	17	44
Siaya	Siaya East Coast women's group	9	10
Vihiga	Imanda women's group	16	15

4 Results

Interviews with both male and female participants at the three project sites revealed different patterns in costs and benefits, shifts in decision-making power and access to opportunities associated with the growth and use of planted forages. Findings show that costs and benefits of adopting forage are unevenly distributed among men and women in different households. The findings are presented in gendered themes, addressing the different research questions of the survey.

4.1 Livestock management feeding practices

Farmers at the study sites were mixed crop/livestock smallholder dairy cattle keepers. They had dairy cows (local zebu and exotic/improved breeds) managed under the extensive, semi-intensive and intensive production systems where crops and livestock production are the major economic activities in supporting livelihoods among households (HHs). Both women and men reported that land available for cultivation in the area is decreasing due to population growth and subdivision. The farm sizes range from 0.5–4 acres across all the study sites. Mixed and relay cropping systems were the most common at all the project sites.

The common livestock management systems at the study sites were open grazing on the roadside or on public land, semi-intensive systems, where animals are partially confined and grazed within paddocks on farms and zero-grazing management systems where animals are completely confined. However, most women and men reported that of late, open grazing and semi-intensive systems are becoming increasingly rare as land subdivision continues to occur. They noted that zero-grazing systems, although relatively expensive, are more productive and profitable. On the other hand, all the farmers agreed that although open grazing is less costly, it offers significantly less return due to low productivity. Some farmers reported that they fear the risk of transitioning to improved breeds because of high feed and animal health care needs. Both men and women farmers reported that the use of concentrates is low across all project sites.

All farmers in the study sites reported feeding animals with crop residues; however, some feed crop residues to animals directly from the fields while others harvest and conserve for future use. While farmers reported that this was also true with planted forages, the study found storage of both crop residues and planted forages was limited due to lack of storage capacity and hence farmers waste a lot of feed during wet seasons, which subsequently contributes to feed shortages in dry seasons. Some farmers reported pulverizing crop residues at a fee of Kenyan Shillings (KSH) 100 per 70 kg bag.

Generally, farmers who grew forages reported practising the 'cut and carry' feeding system, which involves harvesting fodder from the farm and chopping it at the animal shed for feeding. Some farmers reported chopping enough forages to last feeding for 3–7 days. Farmers reported that forages became rancid when kept longer, hence they wilted chopped forages to reduce the water content not only to improve intake but also to improve the storage period. Some farmers fed chopped fodder as is while others added molasses to improve feed intake.

Farmers reported mixing crop residues, e.g. dry maize stover and dry bean husks and mixing with green planted fodder that is perceived to be of a higher quality. A woman farmer said 'My animal feed ration normally comprises dry maize stover, Napier grass and Desmodium when it is available. They are chopped, mixed and fed together.' Farmers also mix different types of forages. One male farmer stated:

I normally chop Brachiaria grass, mix it with Napier grass or sometimes Desmodium grass with maize stover because the grasses are a good source of protein, hence animals become healthy and produce a lot of milk.

Another woman farmer explained, 'I always feed my animals with mixed fodder types. I chop Brachiaria grass, dry it and mix it with Napier grass and sweet potato vines.' Farmers appeared to lack knowledge of forage-based feed formulation. Extension services are largely demand-driven and most farmers only seek them on an 'as needed' basis.

4.2 Farmers perceived benefits of growing and feeding improved forages

Farmers explained that they grow forages because of their benefits, which are summarized in Table 3. All the farmers agreed that feeding dairy cows improved planted forages provides them with better nutrients and minerals, which in turn leads to improved growth and milk production. One farmer said, 'For me, I planted fodder because they have more nutrients and minerals and hence give more milk and good health to cows.' Most men and women farmers reported that feeding dairy animals with improved forages results in more manure production, which is subsequently used to improve soil fertility. A female participant from Vihiga district stated:

Before I started feeding planted forages, I barely had enough manure and I would get only one or two sacks of maize; however, since I started feeding planted forages I get more manure and I now harvest even up to five bags of maize.

All the farmers earn income from the sale of forage, either as individuals or in groups. In particular, the sale of forage by women farmers has led to improved income, which they use to pay school fees, meet basic household needs and to become less dependent on other family members, especially their husbands and adult working children.

Table 3: Farmers' perceived benefits of improved planted forage.

Domain	Perceived benefits
Productivity	Planted forage provides better nutrients and minerals that lead to better growth and milk production.
	Most women dairy farmers at the study sites reported that feeding cows with one type and/or a mixture of Napier grass, Brachiaria grass and Desmodium grass leads to constant increased milk volume and high-quality milk when compared to previous feeding regimes.
	One farmer reported that fodder production has contributed to high milk production due to the availability of quality forage for animals throughout the year. He reported an increased milk production from 1–5 litres per cow per day. Another farmer reported that Brachiaria grass increases the milk volume from 1.5–2 litres or more in one milking for a local breed.
Environmental benefits	Increased manure production. Some farmers reported using fodder refusals for mulching and making compost manure for use in their kitchen gardens
	Farmers also reported planting improved forages for controlling erosion. One farmer reported 'I have planted Brachiaria mulato and I discovered it prevents soil erosion. We normally plant fodder on slopey areas on farms and soil erosion has reduced. Before planting forages, the topsoil would be swept away now and then.'
	All the farmers mentioned the ability of new improved forages to withstand drought. They said this attribute allows for forage availability throughout the year. One farmer said, '...and in my own opinion and observation, the new Brachiaria varieties are drought resistant and evergreen most of the time and ready again for another harvest after 2–3 weeks'.
Economic benefits	Increased income from the sale of forage is often used to invest in other household and farming activities. One farmer reported 'I earn additional income of KSH 2,000 per day from the sale of forage splits, grass hay, milk and fresh fodder. One farmer group reported selling tube silage made from Brachiaria grass at KSH 400 for a 50 kg polythene bag. They sell silage to group members.

4.3 The influence of planted forages in daily household activities of women and men on smallholder farms

Tables 4 and 5 illustrate how women and men respectively spend their typical day on various household activities from when they wake up until the time that they go to bed. The findings show that women spend 3.5–4.5 hours on dairy-related activities each day (Table 4) while men spend 3.5–5.5 hours on dairy-related activities (Table 5). In addition, women spend two hours on farming-related activities while men spend 2.5–3 hours on farming activities. However, women spend an additional 3–4 hours on other household chores (Table 4). Most of the women agreed that the adoption of improved forages has allowed them more time due to reduced time in searching for fodder and hence this increased their engagement in other activities such as selling of milk, community and church meetings and volunteering activities in the communities. The findings show that both women and men have 1–2.5 hours of free time each day but they use the saved time in different ways.

Women asserted that when planted forage is available on-farm it takes less time to harvest fodder and to feed cows as opposed to when they had fetch fodder long distances off-farm. One woman farmer from Rongo stated:

According to me, when I planted enough fodder on my farm, there is great saving on time taken to harvest, chop fodder and feed animals. Today I take shorter time as opposed to those days when I used to travel far distance looking for fodder for my animals.

A woman farmer from Migori added:

I now have extra time to attend to other activities and this has greatly contributed more hours for me to take a rest after taking lunch and sleep more hours at night.

Men echoed the women's sentiments that easy proximity to available planted fodder on farms saved them time to commit to other activities. They reported that they used the extra time to rest and engage in other economic activities. One man reported that:

This planted grass has really reduced time wasted collecting feed off-farm. It has created time to do other duties within our farms. When I have fed my cows, I take the saved hours to go to the farm which I didn't do before.

A man in Vihiga said:

The time I spend collecting fodder off-farm has reduced because I now harvest and feed fodder to animals from nearby the household. Before it took me even up to 4 hours to fetch feed off-farm. But now if I go to my 'shamba' I use 1 hour or less.

Men said they used the saved time on farm activities such as weeding or manure application on crops.

While forage adoption saves time for farmers to engage in other relevant activities, both women and men participants stated that planted forages increased the labour needed for forage production-related activities, including planting, weeding, harvesting and baling. One woman in Rongo reported:

For my case, I would say there is not much difference in hours spent on these activities before and after planting Brachiaria grass. It is 50–50 according to me. Before planting improved fodder, I used to walk my animals, looking for fodder in far places and even tethered them on natural pasture. This used to take a lot of my time and today I have planted fodder for my animals but I still spend a lot of my time to produce fodder on my farm in terms of cultivation, planting, weeding, harvesting, chopping and feeding the animals. All these still take the same time I used searching for fodder in far places.

However, some men observed that once Brachiaria grass is established it forms a thick canopy and controls weeds, thereby reducing the need to weed. One farmer noted:

When Brachiaria grass grows and forms a canopy, other grasses cannot grow. So, it reduces the labour and time for weeding.

They agreed that they use more time to harvest and bale Brachiaria grass, which is a new activity introduced with the adoption of the improved grass. They also pointed out that with improved milk production, they spend more time milking. One farmer noted 'Since the milk volumes have increased, we also take more time to deliver the milk to an increased number of our clients.'

Both women and men agreed on one point, that irrespective of the labour intensity of planted forages, the benefits and income generated from increased milk; and the additional income earned from fodder sales, are enough incentives to adopt improved forages. One farmer from Siaya summed it up well, stating 'Though the workload that we bear has now increased, we are receiving more money. The business has more profit as compared to when we only grazed our animals.'

Table 4: Daily activity clock for household activities for women in a typical day at all study sites.

Hour of the day	Women HH activities in Migori district	Women HH activities in Vihiga district	Women HH activities in Siaya district
4:00am	Wake up and Prayer		
4:30am	Light fire and prepare kitchen		
5:00am	Boil water for milking/ milking	Wake up time	Wake up time
5:30am	Take milk to collection centre	Release cows and milking	Clean the cowshed
6:00am	Prepare breakfast for children	Clean cowshed	Milking cows
7:00am	Prepare fodder for the cows	Make breakfast	Prepare breakfast
8:00am	Feed and water animals	Deliver milk for sale/ MCC	Feed and water animals
8:30am	Feed and water animals	Feed /water livestock	Feed and water animals
9:00am	Feed and water animals	Prepare fodder	Feed and water animals
10:00am	Farming activities	Farming activities	Farming activities
11:00am	Farming activities	Farming activities	Farming activities
12:00 noon	Farming activities	Farming activities	Farming activities
1:00pm	Prepare lunch for family	Prepare lunch for family	Prepare lunch for family
1:30pm	Free/resting time	Prepare lunch for family	Prepare lunch for family
2:00pm	Free/resting time	Free/resting time	Check on livestock/feed and water
3:00pm	Free/resting time	Free/resting time	Check on livestock/feed and water
3:30pm	Feeding and watering animals	Free/resting time	Free/resting time
4:00pm	Feeding and watering animals	Free/Resting time	Free/Resting time
4:30pm	Take cows to milking shed	Feed livestock	Evening milking
5:00pm	Milk/pack milk for sale	Milking	Take milk to collection centre
5:30pm	Milk/pack milk for sale	Milking	Evening feeding for cows
6:00pm	Dinner preparation	Cook supper and serve family	Evening feeding for cows
7:00pm	Socialize with family	Socialize with family	Prepare supper
8:00pm	Socialize with family	Socialize with family	Eat supper
9:00 pm	Socialize with family	Socialize with family	Socialize with family
10:00 pm	Sleep	Sleep	Sleep
Hours on dairy activities	4.5 hours	3.5 hours	4 hours
Hours on farming activities	2 hours	2 hours	2 hours

Table 5: Daily activity clock for household activities for men in a typical day at all study sites.

Hour of the day	Men HH activities in Migori district	Men HH activities in Vihiga district	Men HH activities in Siaya district
4:00am	Wake up		
4:30am	Clean cattle unit		
5:00am	Clean cattle unit	Wake up	Wake up
5:30am	Milking cows	Milking cows	Milking cows
6:00am	Feed animals	Clean cowshed	Take milk to dairy
7:00am	Deliver milk to the MCC	Feed/water cows	Clean cowshed
8:00am	Harvest/chop animal feeds	Have breakfast	Feed/water cows
8:30am	Have breakfast	Harvest/chop fodder	Have breakfast
9:00am	Farming activities	Farming activities	Harvest fodder
10:00am	Farming activities	Farming activities	Farming activities
11:00am	Farming activities	Farming activities	Farming activities
12:00 hrs	Farming activities	Farming activities	Farming activities
1:00pm	Lunchtime	Lunchtime	Lunchtime
1:30pm	Free/resting time	Harvest/chop feeds for next day	Chop fodder
2:00pm	Socialize with friends in local market	Harvest/chop feeds for next day	Chop fodder
3:00pm	Socialize with friends in local market	Harvest/chop feeds for next day	Resting
3:30pm	Socialize with friends in local market	Harvest/chop feeds for next day	Resting
4:00pm	Socialize with friends in local market	Harvest/chop feeds for next day	Evening milking and deliver milk to MCC
4:30pm	Socialize with friends in local market	Harvest/chop feeds for next day	Evening milking and deliver milk to MCC
5:00pm	Deliver milk for sale/MCC	Milking cows	Evening milking and deliver milk to MCC
5:30pm	Deliver milk for sale/MCC	Milking cows	Socialize with friends
6:00pm	Deliver milk for sale/MCC	Shower/rest/listen to radio	Socialize with friends
7:00pm	Dinner, listen to radio/watch TV	Shower/rest/listen to radio	Socialize with friends
8:00pm	Plan for next day's farm activities	Supper with family	Socialize with friends
9:00 pm	Socialize with family	Socialize with family	Socialize with friends
9:00pm	Socialize with family	Sleep	Supper
10:00 pm	Sleep		Sleep
Hours on dairy activities	3.5 hours	5.5 hours	4.5 hours
Hours on farming activities	3 hours	3 hours	2.5 hours

4.4 Women and men decision-making in forage production

Participants were asked to indicate their decision-making roles in the household and agricultural production, as well as their access to and control over land, income and opportunities before and after improved forage adoption. This was done to gain a better understanding of whether forage adoption has had positive changes of inclusion, especially for women, in decision-making and increased their access to and control over income from forage production. The findings are presented in Tables 6, 7 and 8. The findings show that before forage adoption, decision-making on all forage-related activities in households was invariably the domain of men. However, after the adoption of improved forages most decisions on cropping and forage production in households are made jointly, indicating that women are now actively participating in such decisions. Interestingly, women reported that they play a major role in access to information, access to training on forage production and access to fodder markets and in some cases, when to plant the fodder. However, in some districts, decisions on land use such as where to plant and size of land to use for growing forages are still taken mostly by men alone.

Generally, all the farmers agreed that decision-making differs between households. Women narrated that men are culturally recognized as household heads and thus, although women may give input into decision-making on some forage activities, decisions about land use and the number of cows to keep still lies in the domain of men. A woman in Siaya summed it up as: 'If say I want to use plot A for fodder production, he may say no, use plot C and I cannot object.'

Some women in the densely populated Vihiga district reported that it is not only a matter of men deciding on when, where and what to plant. They explained that such decisions could also be determined by who in the HH is receiving information or training about new technologies, the land size and prevailing weather patterns. In general, the member of the household, a man or woman, that has received training is in a better position to decide. In most cases, women tend to receive information/training on new technologies, hence men rely on them to make the decisions.

In Siaya district, women reported that men and women consult and make joint decisions about the size of land to use for forage production, the number of livestock to keep and other related decisions. A woman from Vihiga district emphasized that:

You cannot allow the man to make all these decisions on his own as this may leave the woman with the burden of feeding livestock alone. You both must come to a consensus on the number of animals to keep. You must discuss the number to keep by putting into consideration the amount of land required to plant forages and labour resources available in the household.

Another woman in Siaya district stated that:

On the size of land to use for forages, we discuss and agree on how we are going to use the total land we have. We depend on agricultural crops for food therefore we must decide together how to divide land between crops and forages. It is therefore a joint decision.

Table 6: Women's perceptions on decision-making, access to and control of various activities/resources in forage production.

Activity	Migori district		Vihiga district		Siaya district	
	Before	After	Before	After	Before	After
Where to plant	Men	Men	Men	Men	Men	Men
When to plant	Men	Joint	Men	Women	Men	Joint
Size of land used	Men	Joint	Men	Joint	Men	Joint
Number of animals to keep	Men	Joint	Men	Joint	Men	Joint
Access to information	Men	Women	Men	Women	Men	Women
Access to training	Men	Women	Men	Women	Men	Women
Access to market	Men	Joint	Men	Women	Men	Women
Control over use of income	Men	Joint	Men	Joint	Men	Joint

Table 7: Men's perceptions on decision-making, access to and control of various activities/resources in forage production.

Activity	Migori district		Vihiga district		Siaya district	
	Before	After	Before	After	Before	After
Where to plant	Men	Men	Men	Men	Men	Joint
When to plant	Men	Joint	Men	Joint	Men	Joint
Size of land used	Men	Men	Men	Joint	Men	Joint
Number of animals to keep	Men	Joint	Men	Joint	Men	Joint
Access to information	Men	Joint	Men	Joint	Men	Joint
Access to training	Men	Joint	Men	Joint	Men	Joint
Access to market	Men	Joint	Men	Joint	Men	Joint
Control over use of income	Men	Joint	Men	Joint	Men	Joint

Table 8: Joint men and women's perceptions on decision-making, access to and control of various activities/resources in forage production.

Activity	Migori district		Vihiga district		Siaya district	
	Before	After	Before	After	Before	After
Where to plant	Men	Joint	Men	Men	Men	Joint
When to plant	Men	Joint	Men	Joint	Men	Joint
Size of land used	Men	Joint	Men	Joint	Men	Joint
Number of animals to keep	Men	Joint	Men	Joint	Men	Joint
Access to information	Men	Joint	Men	Joint	Men	Joint
Access to training	Men	Joint	Men	Joint	Men	Joint
Access to market	Men	Joint	Men	Joint	Men	Joint
Control over use of income	Men	Joint	Men	Joint	Men	Joint

Findings from the men's FGDs reinforced the narratives of the women in their FGDs on decision-making on forage-related activities. Table 7 reflects that male participants indicated that they mostly made joint decisions in livestock and forage production, compared to women participants who felt that they mainly contributed to some of the forage production-related decisions (Table 6). A male participant in Vihiga district affirmed that:

Personally, decision-making in forage production has changed. Together with my spouse, we focus on maize production, but now we have also decided to produce our own fodder such as Boma Rhodes because it yields better returns as opposed to maize.

Another male farmer said:

Decision-making has now changed in that we jointly decide on what proportion of land should be allocated for food crops and fodder production. Before I would decide alone on what to plant and where.

Similar sentiments were echoed in Migori district where men participants described how crop rotation decisions needed to be taken jointly as these involved a delicate balance between providing food for the household and fodder for the animals. Men participants said one other main consideration is the net yields, and therefore income, generated by different patches of their land. Farmers in Migori district reported that they value the 'push and pull system' since it provides them with both food and fodder simultaneously. One farmer said that:

When we notice a patch of the farm is dominated by Striga weeds we establish push-pull technology; instead of planting maize alone we also plant Brachiaria grass which we sell to earn income.

4.5 How adoption of improved forages influences access to and control over income in households

As already observed, all the farmers agreed that planted forages have increased the amount of feed for livestock, the milk yield per cow and hence the amount of money they earn from the milk sales and the surplus fodder, especially during the rainy seasons. They reported different levels of access to and control over income from livestock and forages after adopting forages. The access to and control over income is mostly influenced by the type of household, i.e. whether it is a male-headed or a female-headed household. In Vihiga district, among male participant FGDs, in male-headed households they tend to have equal access to and control over income with women, particularly concerning proceeds coming from the sale of milk. A male participant from Rongo Dairy Cooperative said:

For example, when I milk the cows, my wife takes the milk to the market for sale. When she comes back in the evening with money from the sales. I cannot decide alone on the use of the money. We must sit down together and budget for it.

Male participants from the Rongo Dairy Cooperative reported that they have been sensitized through the dairy cooperative education programs to empower women through dairy farming, hence most men have let their spouses take on more roles in dairy activities, especially milking cows, delivery of milk to collection centres and receiving payment for the milk delivered. This implies that women have full access to milk sales and income. This observation was reinforced by some women but they said inasmuch as they have full control of milk and in some cases fodder sales, they still consult their husbands on how to use the income. On the other hand, women who are household heads have full access to and control of the income they make from their dairy and forage production enterprises. A woman from Rongo district said:

Those of us who are widows have full access to and control of farm gate milk sales as well as milk delivered to the dairy cooperative. We also have full control over all crop proceeds, including from the sale of planted fodder.

4.6 How adoption of planted forages influence control over land use and livestock ownership in households

At all the study sites, men and women participants described how the adoption of improved forages has influenced access to and control over land use and livestock ownership in households. In the Rongo district, men participants reported an increase in the number of cattle kept per household due to improved availability of fodder. They gave an example of opting to rear calves after birth rather than sell them. A male farmer in the Rongo district reported that 'Before planting forages, I was having only one cow but now that I have more fodder, I decided to add a second cow.' Men and women agreed that improved forages have changed their farming practices. They said before planting improved forages they left some of their land fallow. They reported that planting forages on these portions of land now serves the purpose of protecting the fallow land from encroachers who previously grazed cattle on it illegally. Some farmers reported that they have decided to commit more land to planting improved forages to ensure enough forage for their cattle during the dry season.

4.7 Men and women access to milk/fodder markets and training opportunities

Men and women farmers concurred that the introduction of improved forages has increased their access to training opportunities from various organizations including ILRI, *icipe*, Dairy Goats Association, the Department of Livestock Production at Ministry and County government levels. Farmers reported receiving training in animal husbandry, fodder production, management, conservation and use. Farmers from the Chandri Women's Group in Rongo district reported having gained a lot of knowledge through the training given by extension officers through ILRI on how to plant improved forages such as *Brachiaria* grass and Napier grass using the 'Tumbukiza' method, how to mix forages with crop residues and other feeds, including cereal by-products. They said they are now knowledgeable on how to plant forages and how to chop and mix them into rations. One woman farmer from the Chandri Women's Group said:

We have been taught how to prepare homemade rations to substitute for the expensive commercial concentrates, which are often very expensive. We have received a new variety of Napier grass that is easy to handle.

All the farmers reported increased fodder markets that allowed farmers to generate more income through the sale of planted forages and more milk. They noted that there was an improvement in the body condition of cows due to good feeding and that this increased the value of the cows. All the farmers said that there was an increased demand for fodder that was not previously there before the introduction of improved forages. Indeed, a male participant from Migori district attributed improved fodder business to the increased planting of improved forages on smallholder farms. Farmers observed that the more the farmers adopted improved livestock breeds, the more the demand for planted forage increased.

4.8 How planted forages affect men's participation in the feeding and care of dairy cows

Men and women agreed that men are now more involved in dairy cattle husbandry, feeding and marketing activities following the introduction of improved forages. Women observed that the introduction of planted forages made access to forages easier and reduced the time men spent collecting animal feeds or grazing animals for longer periods off-farm. A male participant from Rongo district said:

In the past, I was taking a lot of time collecting fodder off-farm. Sometimes I must hire somebody else to help me collect and carry feed home. But now I am taking much less time because I just need to harvest fodder on farm.

Another male farmer added 'To add on that, we can now delegate feeding to other household members because feed is easily available on farm. Before we would spend more time sourcing for it'. A woman participant from Rongo district emphasized the men's observation above by saying:

With the introduction of planted fodder, my husband no longer walks all over grazing our animals on natural pastures, instead he supports me in harvesting and chopping fodder as well as feeding the animals.

However, in the men's discussions, it emerged that what motivated men to spend more time in fodder production was the increase in milk production and income from the growing of planted forages. A male participant from Migori district summed it up, saying 'My cows are getting better feeds, hence more milk production.'

4.9 How planted forages has improved feed availability on farms

Both men and women farmers mentioned that the introduction of planted forages has greatly boosted feed availability on farms not only during rainy seasons but also in dry seasons. This has made feeding animals worthwhile compared to when they had not planted improved forages. It has improved milk production and in turn daily and regular HH income. Farmers mentioned that they get a significantly greater biomass yield from improved *Brachiaria* grasses and *Desmodium* than from cutting natural grasses in public areas. They said that it is possible to conserve the improved fodder by making hay to feed during the dry season or as the need arises. One farmer from Rongo district said 'We harvest more and better quality feeds throughout the year that supports steady milk production on farms.'

4.10 Gender roles and labour input in forage production management, use and marketing

Men and women farmers separately and in mixed FGDs listed key activities in forage production, management, use and sale (see Tables 6 & 7). In general, both men and women farmers are involved in different activities associated with forage production, sale and use but to varying degrees. In Rongo district, women and men perceived that men are mainly involved in land preparation and cultivation, harvesting chopping and conserving feed. Women are mostly concerned with seedbed preparation, manuring, planting, weeding and watering animals. In Vihiga district, women stated that all activities related to forage production are performed jointly. However, they rated their involvement in the activities very high (on average 7 out of 10 scores), suggesting that as far as women are concerned, even though men are now becoming involved in forage production women still contribute the most to these activities. In Siaya, both women and men farmers perceived that most forage-related activities were performed by men. Even in cases where the men perceived joint efforts in forage production, they still rated their involvement very high (on average 7 out of 10 scores). The same trends were observed in joint women and men FGDs in all districts.

Table 9: Perceptions of women and men about their participation and labour input in forage production, management and use in Kenya.

Activity	Women focused group discussions						Men focused group discussions					
	Rongo district		Vihiga district		Siaya district		Rongo district		Vihiga district		Siaya district	
	Gender	Rating ¹	Gender	Rating ¹	Gender	Rating ¹	Gender	Rating ²	Gender	Rating ²	Gender	Rating ²
Bush clearing	Men	5	Joint	4	Joint	4	Men	5	Joint	7	Men	5
Land cultivation/ Ox plough	Men	4	Joint	6	Joint	4	Joint	7	Joint	5	Men	7
Seed bed preparation	Joint	6	Joint	5	Joint	5	Joint	5	Joint	5	Joint	5
Land re-tilling	Joint	5	Joint	5	Joint	0	Joint	7	Joint	5	Joint	6
Construction of feed store	Men	2	Joint	4	Joint	2	Men	8	Joint	9	Joint	7
Weeding forages	Joint	7	Joint	9	Joint	0	Joint	3	Joint	4	Joint	5
Planting forages	Joint	8	Joint	8	Joint	5	Joint	5	Joint	5	Joint	4
Harvesting forage	Men	6	Joint	7	Joint	4	Joint	5	Joint	6	Men	5
Baling hay	Men	3	Joint	4	Joint	5	Men	9	Joint	7	Joint	7
Chopping feed	Men	7	Joint	6	Joint	4	Men	7	Joint	6	Men	8
Manure application	Joint	8	Joint	6	Joint	5	Joint	4	Joint	3	Joint	5
Feeding/watering	Joint	7	Joint	8	Joint	4	Joint	4	Joint	4	Joint	5
Fodder storage/conservation	Joint	3	Joint	4	Joint	0	Men	7	Joint	7	Joint	5

Rating 1 - Women perception of their own involvement on forage related activities

Rating 2 - Men's perceptions of their own involvement in forage related activities

Source: Separate FGDs for men and women, Kenya, December 2018.

Table 10: Perceptions from joint women and men discussions on their participation and labour input in forage production, management and use in Kenya.

Activity	Joint women and men focused group discussions					
	Rongo district		Vihiga district		Siaya district	
	Gender	Rating ³	Gender	Rating ³	Gender	Rating ³
Bush clearing	Men	8	Joint	6	Joint	9
Land cultivation/ Ox plough	Men	10	Joint	8	Men	8
Seed bed preparation	Joint	5	Joint	4	Joint	4
Land re-tilling	Joint	5	Joint	5	Joint	5
Construction of feed store	Men	5	Joint	5	Joint	10
Weeding forages	Joint	4	Joint	4	Joint	3
Planting forages	Joint	5	Joint	5	Joint	3
Harvesting forage	Joint	5	Joint	6	Joint	6
Baling hay	Men	6	Joint	7	Joint	7
Chopping feed	Joint	6	Joint	5	Joint	5
Manure application	Joint	5	Joint	5	Joint	2
Feeding/watering	Joint	5	Joint	5	Joint	3
Fodder storage/conservation	Joint	5	Joint	6	Joint	5

Rating 3 – Joint women and men perceptions about men's participation in forage related activities

Source: Joint men and women FGDs, Kenya, December 2018

4.1 Constraints and opportunities facing women and men in forage production, management use and sale

In Vihiga, both women and men reported several constraints. Women in particular cited limited access to adequate land for planting forages as a major constraint. A woman participant stated that:

When Brachiaria grass was introduced to us we had already planted other types of fodder varieties and since our land is small, we were unable to immediately replace with the new grass.

Most women and men farmers reported the lack of a steady market to sell baled grass. A woman farmer said:

Some farmers have planted a lot of Brachiaria grass but have no market to sell the baled hay. We would like get access to a market where we can consistently sell our fodder and wait for payment later.

Farmers are willing to produce fodder and sell in bulk; however, one farmer attributed the lack of fodder market to the absence of hay aggregators in the area. Farmers said they were unable to aggregate fodder and sell in bulk to contracted markets. It emerged that farmers were also unwilling to consolidate fodder and sell in bulk jointly. One male farmer attributed it to a lack of farmer information about the benefits of bulking fodder for sale. Farmers added that this could be made possible if they had storage facilities. They reported that some farmers were unwilling to contribute towards the construction of a store or hiring a warehouse.

Both women and men farmers reported pests and disease attacking forages as a major constraint that reduced biomass yield on farms. They reported that Napier grass was becoming infected with a disease that made it turn yellow and stop growing when it got to a certain stage of growth. One male farmer in Vihiga district said 'If you are relying on Napier grass when the disease strikes, then you are likely to lack feeds for cows'. The symptoms described by farmers are likely to be those of the Napier stunt disease (NSD). The NSD was first observed in Kenya in 2002. The disease symptoms include yellow, soft, stunted leaves, sometimes streaked or red, which led to tillers dying.

Symptoms start on some tillers and eventually affect the whole plant. This disease is caused by a phytoplasma that is transmitted by a leafhopper (Asudi et al. 2015). In Vihiga district, farmers observed that some disease had started affecting grasses, particularly *Brachiaria brizantha* cv *Xaraes*. The disease makes the grass dry with dark spots. It is like rust. The symptoms appear similar to those of spider mite (*Oligonychus trichardti*) damage. The first symptom of spider mite damage is the appearance of small white or yellow dots and then the leaves turn completely yellow (Cheruiyot et al. 2018).

Farmers reported that seasonal and climatic variations sometimes affected their decisions on growing forage in terms of germination and growth rates. The farmers said the timing for planting forage is critical. A male farmer in Siaya said 'We all planted *Brachiaria* grass during heavy rains. The rainwater swept away our seedlings and other seedlings did not germinate.' Another farmer added, 'If you plant when there is little rainfall the grass does not grow well. Timing is very important for every crop. Planting *Brachiaria* grass needs correct timing.'

Farmers also reported that they lacked knowledge on the appropriate time to harvest forage, hence, the forage overgrows and becomes difficult to graze and unappealing to cows. One farmer in Vihiga district reported that:

We have had the challenge of identifying the right time to harvest our fodder. When you leave it to overgrow, it becomes too tough and difficult to even chop it. Cows also have difficulty in feeding on overgrown Brachiaria grass.

As a result of this, *Brachiaria* grass is a challenge for most farmers to harvest. A male farmer in Migori district said 'Harvesting *Brachiaria* grass is a bit challenging compared to Napier grass. It gives most people a problem. I use a sickle to cut grass and sometimes workers avoid cutting it.'

A male farmer in Rongo district observed:

When you use a sickle to harvest, it takes more time and you can only harvest a small portion at a time. We would be happy to get a machine that can harvest the Brachiaria grass, which would reduce the time we take to harvest the fodder.

Farmers also said they lacked knowledge in the area of forage conservation. One woman farmer in Migori district said 'Sometimes I have to give away excess *Brachiaria* grass because I do not know how baling is done.' A male farmer from Vihiga district added, 'And also most of us don't have the baling boxes. We sometimes use silos to conserve forages but it is tedious.'

Concerning opportunities that fodder offers to farmers, the men and women agreed that the major advantage was the time saved fetching feed off-farm, increased income from high milk production and sale from fodder, which benefitted all farmers, irrespective of gender.

5 Discussion

The purpose of this study was to explore gender dynamics and social implications of improved planted forage adoption in dairy systems in Kenya. The study used a qualitative analysis through FGDs to access the distribution of costs and benefits, decision-making, access to and control over land, income and livestock, constraints and opportunities for men and women farmers in Kenya. Generally, the findings revealed that men, women and children participate in activities of growing and management of improved forages such as land preparation, planting, irrigating, harvesting, conserving and selling of forages, as well as other related dairy activities at varying levels. Additionally, the adoption of improved planted forage has resulted in differential costs and benefits for men and women farmers, including changes in decision-making about growing of forages, reduced labour burden for both men and women in terms of sourcing and preparing feeds, easy access to more and nutritious forages, increased access to training and information for women, increased involvement by men in dairy feeding and improved market opportunities. All these gains have resulted in healthy, more productive cows and hence increased income.

The study shows that the perception of roles and responsibilities between men and women differs between sites. In some sites, men are reported to be mainly involved in land preparation and cultivation, harvesting, chopping and conserving feed. On the other hand, women are mostly involved in seedbed preparation, manuring, planting, weeding and watering animals. In some sites, women reported that all activities related to forage production are performed jointly with men. However, they rated their involvement as higher than that of men, suggesting that even though men are gradually becoming more involved in forage production activities, they still carry the heaviest burden of the work. This finding is consistent with the findings of previous studies, that women's participation in forage and livestock production activities is greater than that of men (Njarui et al. 2012; Arora et al. 2017).

The findings showed that smallholder dairy farmers face different types and levels of severity of constraints following the adoption of improved forages. The main constraints revealed by both men and women farmers were pests and diseases and the lack of a ready market for excess forage. However, women reported being constrained by limited access to and control over land while men reported that their main problem was the lack of baling equipment, limited technical know-how about baling hay and lack of hay barns for storage. These findings are consistent with previous studies that highlighted the gender differentials in terms of constraints to technology adoption (Doss 2001; Doss & Morris 2001). Doss (2001) found that women's limited access to and control over land and loose land tenure has a negative implication for the adoption of technology, including improved planted forages. Maleko et al. (2018) found that limited and/or lack of technical know-how affects forage production and use in dairy production in East Africa.

The findings revealed reduced labour requirements in terms of searching for feeds and forages for livestock. There was evidence that improved planted forages provided some "free time" for men and women to engage in other farming and non-farming activities. Both men and women dairy farmers reported finding more time to engage in other farming activities such as poultry production, weeding, manuring food crops and tending to animals.

Women reported using their free time mainly to attend church and community meetings and volunteering to do community duties. Men reported committing their free time mainly to leisure and other off-farm activities. This finding agrees with earlier studies showing that time-saving was the main driver of forage adoption, particularly for women (Peters et al. 2001; Ashley et al. 2018). It further emerged that other activities related to forage production such as land preparation, weeding, watering, harvesting and baling cause an increased labour burden for forage adopters. In the current study, the labour burden on women mainly increased due to their participation in land preparation, weeding and irrigating forage. Men's increased labour (drudgery) is due to harvesting fodder and transporting the fodder to the homestead manually, in addition to other activities such as ox ploughing and land clearing. Women's added roles in forage production activities, coupled with their productive and reproductive roles, suggest the adoption of improved forage may increase their labour burden, consequently affecting their well-being (Benard et al. 2002; Arora et al. 2017; Theis et al. 2018).

A significant finding of this study is the implications of forage adoption on household and agricultural decision-making. The results showed a variation in men and women's participation in household and agricultural decision-making in terms of where and when to plant forages, the size of land to commit to forages and how many cattle to keep. Generally, forage adoption appears to encourage joint decision-making where women are actively involved in decision-making by men compared to before the adoption of forages. This implies that women could be empowered to bargain with men for their preferences and needs in terms of forage production. However, it emerged that men have stronger and reserved rights over land use and decisions over the size of land to use for forage production, which may limit women's ability to express such rights in the context of improved forage adoption. Thus, in the context of Kenya, where women have limited access to land, their preferences and benefits in forage adoption are more likely to be affected. This finding concurs with the findings of Theis et al. (2018) who indicated women's tenuous land rights constrain decision-making power on the use of the land and management rights on where, when and how the technology is used.

Furthermore, women reported that decisions on what farming activities to undertake are also influenced by access to [extension] information and the recipient of that information, resources, i.e. land size and weather patterns, and not necessarily only the adult male of the household. Women also reported that their access to fodder/milk markets and training opportunities has changed their involvement or influence in decision-making and control over income. In terms of control over household income, this varied by the type of household. The emerging pattern from married respondents in male-headed households indicated more joint decision-making on the use of household income from sale of fodder and/or milk, while women farmers in both female-headed and widow-headed households made the decisions on income use.

The findings also show that improved planted forages increased income at the household level, which aligns with the findings of earlier studies (Peters et al. 2001; Place et al. 2009; Ashley et al. 2018). Most importantly, women dairy farmers who adopted improved forages reported that they earn money from the sale of fodder and/or milk, which enables them to pay school fees, meet their basic needs, buy household items, avoid borrowing money and be independent of relying on family members, especially husbands and adult children.

This finding suggests that improved forages could be a candidate technology for improving livelihoods and economic empowerment of women, which could be used to influence decision-making within the households (Agarwal 1997). The study further revealed that improved forage production ensures adequate availability of feed, improved feed quality and reduced time spent on searching for feed. This will alleviate feed shortages for smallholder farmers, especially in the dry season, reduce the cost of feeding and ensure year-round availability of feed on farms (Peters et al. 2001; Lukuyu et al. 2017). Smallholder dairy farmers reported planting Napier grass, *Brachiaria* hybrid cultivar cv. Mulato II, *Desmodium* greenleaf, *Calliandra calothyrsus*, Rhodes grass and *Brachiaria* cultivars, namely *B. decumbens* cv *Basilisk*, *B. brizantha* cv *Piata* and *B. brizantha* cv *Xaraes* in the study areas. Farmers said they fed these varieties singly or as a mixture. Anecdotal evidence from farmers suggested that feeding improved planted forages had a positive effect on milk yields of farmers who have adopted improved forages. Place et al. (2009) empirically demonstrated the impact of fodder trees on milk production and income among smallholder dairy farmers in Kenya.

6 Conclusions

This study has contributed to the understanding of gender in the adoption of improved forages on smallholder farms. The findings show there are gendered dynamics and social implications during and after adoption of improved forages. In addition, the study provided insight into gender division of labour in forage production and related activities in Kenya. This research is one of the few that has highlighted the critical roles of women in forage production, sale and use.

Particular attention should be given to gendered constraints that affect adoption to support farmers to achieve the intended benefits. Participants were confident with the adoption of forage and its potential to increase income for households. Men and women participate in growing and managing improved forages as well as other related dairy activities at varying levels. Participants were assured that improved forages save them time to engage in other community and social activities. Planting of improved forages has changed decision-making on the growing of forage, reduced the labour burden for men and women in terms of sourcing and preparing feeds, facilitated access to more and nutritious forage, increased access to training and information for women, increased involvement by men in forage production and dairy feeding and improved market opportunities. However, the adoption of improved forages has created extra workload for all farmers. Women have taken up the additional role of managing forages while men have taken up the additional roles of manually harvesting and transporting fodder for feeding cattle. Men's stronger and reserved rights over land use and decisions over the size of land committed to forage production may limit women's ability to express such rights in the context of improved forage production. However, women's increased access to fodder/milk markets and training opportunities has changed their involvement and influence in decision-making and control over income associated with forage production favourably.

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