RESEARCH PROGRAM ON Livestock

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Criteria that farmers use to select forage varieties to plant in Uganda

Ben Lukuyu[1], Ronnie Ahumuza[1] and Kevin Maina[2]

[1]International Livestock Research Institute (ILRI), Kampala, Uganda

[2]International Livestock Research Institute (ILRI), Nairobi, Kenya

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Alliance

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Patron: Professor Peter C Doherty AC, FAA, FRS
Animal scientist, Nobel Prize Laureate for Physiology or Medicine–1996

Box 30709, Nairobi 00100 Kenya
Phone +254 20 422 3000
Fax +254 20 422 3001
Email ilri-kenya@cgiar.org

ilri.org
better lives through livestock

ILRI is a CGIAR research centre

Box 5689, Addis Ababa, Ethiopia
Phone +251 11 617 2000
Fax +251 11 667 6923
Email ilri-ethiopia@cgiar.org

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Introduction

Livestock is a major source of food and income for most rural households in sub-Saharan Africa (Baltenweck et al. 2020b; ILRI, 2019; Kristjanson et al. 2010; Tekalign 2014). Increased urbanization coupled with concomitant changes in consumer preferences has increased demand for livestock and livestock products (Baltenweck et al. 2020b; ILRI, 2019; Maina et al. 2020). However, livestock productivity is often hampered by limited feed resources, characterized by their suboptimal quantities and lower nutritional contents (Lukuyu et al. 2009, 2018; Maina et al. 2020; McKune et al. 2015). Smallholder farming systems are characterized by the production of forage and fodder as a side-line activity integrated with crop production. Increased climate variability manifested in the form of prolonged drought and high temperatures negatively affect forage quality and thus, variability in animal nutrition. Consequently, feed scarcity increases the burden on household members especially women, albeit they are constrained by time poverty (Bain et al. 2018; Tangka and Jabbar 2005).

The production and utilization of greater quantities of improved planted forages can not only result in an improvement in milk yield per ton of forage consumed but also reduce the cost of livestock production without compromising productivity, thus, increasing on-farm sustainability. Due to competing land usage, most dairy farms in Uganda are shifting to intensive systems as opposed to extensive systems (Odero-Waitituh 2017). Thus, the integration of improved forages into mixed-farming systems would reduce the competition for land (Philp et al. 2019).

Feed interventions have been promoted over the years most especially within livestock systems in the Eastern and Southern Africa (ESA) region. Most of the interventions have been through projects by centres of CGIAR and its partners (Baltenweck et al. 2020a). However, the uptake of these forages has largely remained low. In Uganda, Gendered Feed Assessment Tool (G-FEAST) assessments conducted in 2020 indicated that farmers use very limited improved forage varieties (Lukuyu et al. 2021a; Lukuyu et al. 2021b). The low uptake can be attributed to poorly developed forage seed systems (Chakoma and Chummun 2018; Chakoma and Chummun 2019). Additionally, farmers are not aware of improved forage varieties and lack knowledge on forage establishment, yet they are faced with making the important decision about which forages to plant on their farms.

The starting point for promoting improved forage productivity is economically viable production and distribution of forage seeds, including vegetative splits (hereafter referred to as 'forage seed'). Production and marketing of forages and forage seed for profit will offer an important service for further professionalization of the dairy industry (Lukuyu et al. 2009b). If for-profit forage seed production and marketing would be easy, a well-developed forage seed industry would already exist. Even though the milk market is attractive and growing, this does not automatically imply the same for forage seed.

As a priori to promote the adoption of forages through public-private partnerships, there is a need to identify which forage varieties better suit different areas based on culture and biophysical characteristics. Therefore, this underscores the need to investigate what factors farmers consider when selecting forages to plant on their farms (Figure 1).

Figure 1: On-farm forage rating session with dairy farmers in Dwaniro Kiboga, Uganda.

Photo credit: Kevin Maina/ILRI.

Through the Feed and Forage Seeds System project, this study sought to provide insight on how to effectively invest public and private resources in the development of a functioning forage seed sector, offering quality forage seed to the diversity of demands by forage seed users in Uganda.

Methodology

The study was carried out within the Feeds and Forage Seed System project sites in three livestock production clusters in Uganda namely, improved intensive systems in the Central region, improved extensive systems in the Western region, and traditional extensive systems in the Central region cattle corridor. Under the research question 'How can the use of high-quality forage seed of improved varieties best be promoted?' the project had set up demonstration plots for various forages and had held field days for farmers. Using a participatory research approach, the study sought to appraise the planted forages and assess the criteria farmers use in selecting forages.

The study design entailed the use of focus group discussions (FGDs) and in-depth interviews with individual farmers. The FGDs were conducted with approximately 10 farmers per site bringing the total sample size to 40 farmers (Table 1). The farmers were asked about their awareness of the different improved forage varieties, the factors they consider before adoption of specific forage varieties, challenges they face that hinder the adoption of improved forages, and the different forage varieties that were promoted during the farmer field schools.

In this study, awareness was defined as the knowledge or perceptions that farmers have concerning improved forage varieties. Adoption was defined as the choice to acquire and use new/Improved forage varieties. A farmer who uses at least one of the improved forage varieties is referred to as an adopter while a non-adopter is one who does not use any of the improved forage varieties.

Results

Table 1: Attendance of the focus group discussions by gender

Site	Male (%)	Female (%)
Bwizibwera-Mbarara	78.6	21.4
Dwaniro-Kiboga	80	20
Kyakabunga-Kiruhura	77.8	22.2
Nagojje-Mukono	88.9	11.1

Across all the livestock systems, the percentage of male farmers that took part in the in the FGDs was higher compared to that of the females. On average, 80% of the participants were male while 20% were female. In Uganda, livestock rearing is predominantly a male activity and a lot still needs to be done for the engagement of women across all the livestock value chains and systems (Williamson 2016). In the same regard, gender aspects in the livestock systems must be considered when promoting forage production across all the production systems. For example, women found it difficult to adopt forage varieties which they considered too bulky to carry. Those who adopted the same had to incur extra costs on labour to help with both harvesting and carrying for the animals to feed.

Within the different livestock systems, farmers had planted some forage varieties as a result of exposure to information that they had earlier on received from different interventions including those promoted by the International Livestock Research Institute (ILRI), the National Livestock Resources Research Institute (NaLIRRI) and Heifer international. The forages that were grown by the farmers across the three livestock systems include Napier grass (*Pennisetum purpureum*), local *Brachiaria*, Kikuyu grass (*Pennisetum clandestinum*), Rhodes grass (*Chloris gayana*), Guatemala grass (*Tripsacum laxum* Nash), Greenleaf desmodium (*Desmodium intortum*) and Silverleaf desmodium (*Desmodium uncinatum*), forage sorghum (*Sorghum bicolor* L. Moench), panicum(*Panicum*), forage cowpea (*Vigna unguiculata*), maize forage (*Zea mays L*), calliandra (*Calliandra calothyrsus*), and lablab (*Lablab purpureus*). Rhodes grass and local *Brachiaria* are the most common varieties that were grown in all the livestock systems (Table 2).

Table 2: Forages that were commonly planted by the farmers

Site	Bwizibwera-Mbarara	Dwaniro-Kiboga	Kyakabunga-Kiruhura	Nagojje-Mukono
Production system	Improved extensive	Traditional extensive	Improved extensive	Improved intensive
Napier grass	√		√	√
Local *Brachiaria*	√	√	√	√
Kikuyu grass	√			
Rhodes grass	√	√	√	
Guatemala grass	√		√	
Greenleaf desmodium	√			
Silverleaf desmodium	√			
Forage sorghum		√		
Panicum		√		
Forage cowpea		√		
Maize forage			√	
Calliandra			√	
Lablab			√	

When selecting a forage variety for planting, it must meet certain criteria as set by the farmers including:

1 The nutritional value obtained by the animal from the forage. The farmers assert that the forage must be highly nutritious in terms of the fibre and the protein content.

2 The ability of the forage to adapt to the climatic and soil conditions for the area is also paramount. Most of the livestock sites experience prolonged seasons of drought and therefore farmers tend to select forages that will withstand the prolonged drought periods. Places like Dwaniro have sandy soils and forages selected by the farmers should be able to grow in such conditions.

3 The rate of regrowth of the forage after harvest is also considered. Farmers prefer forage varieties that have a faster rate of regrowth as this guarantees the availability of feed for the animals as and when it is required.

4 Different forms in which the forage can be used as feed: Forages that can be fed to animals both as fresh feed and as hay/silage are preferred by the farmers. Farmers feel the need to preserve forages to be able to feed the animals during the dry season.

5 The yield potential of the forage is also considered. High-yielding varieties are more likely to be selected for planting since this translates into more feed for the animals.

6 The ability of the animal to digest the forage is also a prerequisite for the farmers. Forages that are highly palatable and digestible by the animals are considered for planting.

7 Forages that can be used as both feed and planting material are also preferred by the farmers. The rationale is that propagation of these forages is easy if the farmer needs to increase production.

8 The vegetative properties of forages such as bulkiness and presence of thorns are also considered. Farmers normally choose forages that are easy to handle. This also mainly applies to women who find it hard to carry bulky and thorny forages (Table 3).

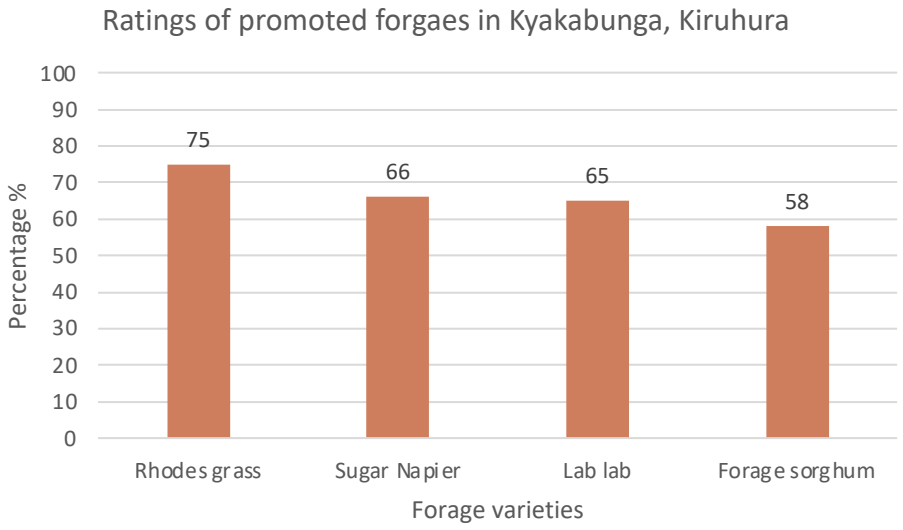
Table 3: Criteria used by farmers when selecting forage varieties to plant

Site	Bwizibwera-Mbarara	Dwaniro-Kiboga	Kyakabunga-Kiruhura	Nagojje-Mukono
Production system	Improved extensive	Traditional extensive	Improved extensive	Improved intensive
Nutritional value obtained by the animal from the forage	√		√	√
Ability of the forage to adapt to the climatic and soil conditions of the area	√	√		
Rate of growth of the forage	√			√
Different forms in which the forage can be used as feed i.e. hay and silage	√		√	
Yield potential of the forage	√	√		√
Ability of the animal to digest the forage	√			
Different uses of the forage i.e. used as both feed and planting material		√	√	
Vegetative properties that make handling difficult like bulkiness and presence of thorns		√		√

With the introduction of the farmer field schools, several forage varieties were promoted across all the production systems and sites. The farmers rated[1] the forage varieties that were promoted at the demonstration sites during the farmer field schools against the selection criteria that they had earlier on stated.

The forage varieties that were promoted in Kyakabunga, Kiruhura District were Rhodes grass (*Chloris gayana*), sugar Napier (*Cenchrus purpureus*), lablab (*Lablab purpureus*) and forage sorghum (*Sorghum bicolor* L. Moench). The above varieties were rated as shown in the Figure 2 below.

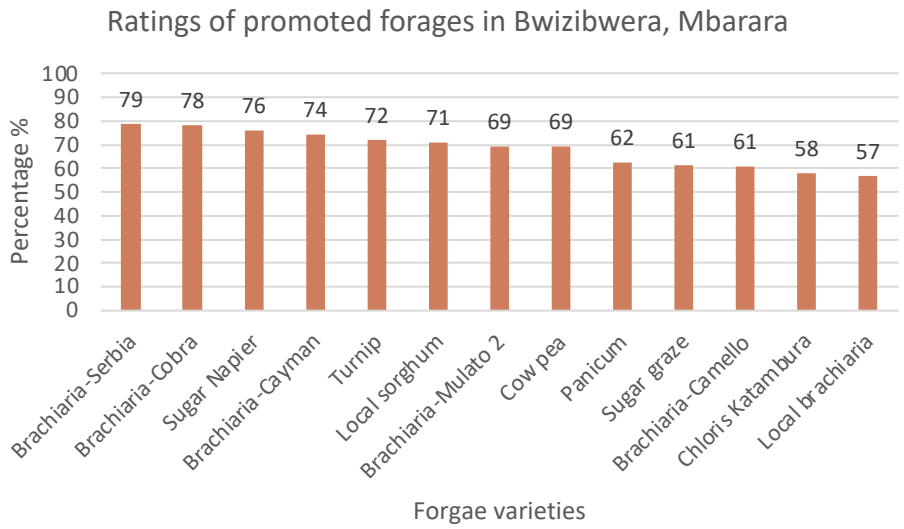
Figure 2: Graph showing the ratings of forage varieties as per the selection criteria in Kyakabunga-Kiruhura District.



1 Ratings are expressed as percentages

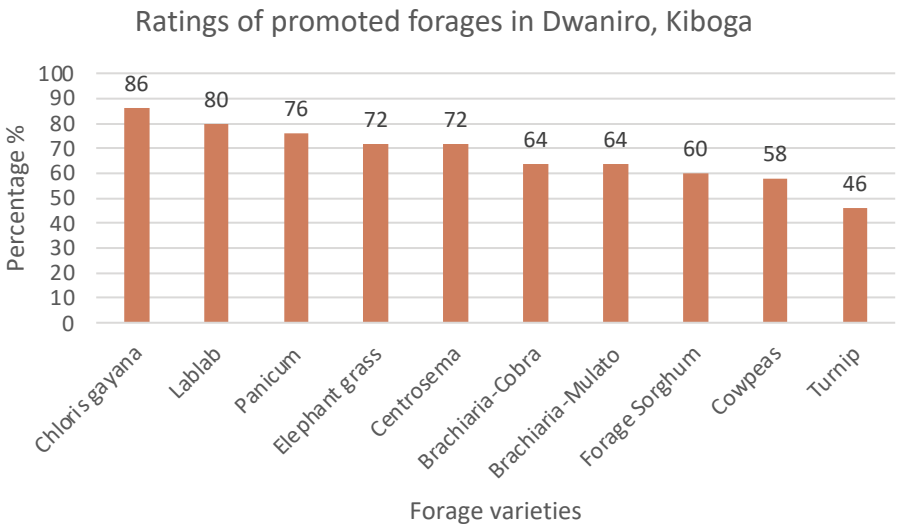
The forage varieties that were promoted in Bwizibwera, Mbarara District include *Brachiaria Serbia*, *Brachiaria cobra*, sugar Napier (*Cenchrus purpureus*), *Brachiaria cayman*, turnip (*Brassica rapa*, local sorghum (*Sorghum bicolor L. Moench*), *Brachiaria Mulato* 2, cow pea forage (*Vigna unguiculata*), panicum (Panicum), sugar graze (Sugar graze), *Brachiaria Camello*, *Chloris Katambura* and local *Brachiaria*. The forage varieties were rated as shown in the Figure 3.

Figure 3: Graph showing the ratings of forage varieties as per the selection criteria in Bwizibwera, Mbarara District.



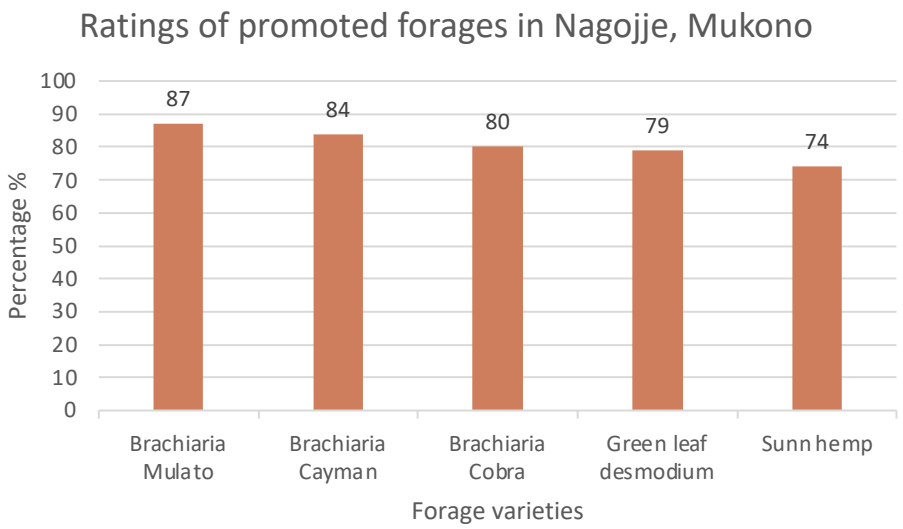
The forage varieties that were promoted in Dwaniro, Kiboga District include, Rhodes grass (*Chloris gayana*), lablab (*Lablab purpureus*), Panicum, Napier grass (*Pennisetum purpureum*), centrosema (*Centrosema pubescens*), *Brachiaria cobra*, *Brachiaria Mulato*, forage sorghum (*Sorghum bicolor* L. Moench), cowpeas (*Vigna unguiculata*), and turnip (*Brassica rapa* subsp. Rapa). The forage varieties were rated as shown in Figure 4.

Figure 4: Graph showing the ratings of forage varieties as per the selection criteria in Dwaniro, Kiboga District.



The forage varieties that were promoted in Nagojje, Mukono District include *Brachiaria cobra*, *Brachiaria Mulato*, *Brachiaria cayman*, Greenleaf desmodium (Desmodium *intortum*) and Sunn hemp (*Crotalaria juncea*). The forage varieties were rated as shown in Figure 5.

Figure 5: Graph showing the ratings of forage varieties as per the selection criteria in Nagojje, Mukono District.



Farmers across the three livestock production systems faced several challenges limiting the adoption of the improved forage varieties. These included prolonged seasons of drought, which hinder the proper growth of the forages. Moreover, there are extremes such as flooding that are common in Dwaniro leading to soil leaching resulting in poor soil fertility. The poor soil conditions hamper the establishment and multiplication of certain forage varieties. Other challenges include pests and diseases and scarcity of labour, which is essential for establishment and maintenance of forages. Farmers also have limited access to finance that is necessary for investing in forage establishment. Also, low and often volatile milk prices limit investment in the dairy enterprise including forage establishment.

Farmers have limited access to quality forage seeds as most of the forage seed is imported and often not affordable. There is lack of knowledge on the necessary agronomic practices among the dairy farmers with most of them unaware of the opportunities available in commercial forage production. The forage sector lacks inclusivity of the youth and women who have limited access to land resources for forage production (Table 4).

Table 4: Challenges that hinder adoption of improved forage varieties

Site	Bwizibwera-Mbarara	Dwaniro-Kiboga	Kyakabunga-Kiruhura	Nagojje-Mukono
Production system	Improved extensive	Traditional extensive	Improved extensive	Improved intensive
Prolonged seasons of drought	√	√	√	√
Pests and diseases that attack the forages	√		√	
Poor soil conditions	√			
Scarcity of labour for establishment and maintenance of the forages	√		√	√
Limited access to finance especially for initial establishment of forages	√		√	√
No access to quality seeds for planting	√	√	√	√
Lack of knowledge on agronomic practices	√	√	√	√

Site	Bwizibwera-Mbarara	Dwaniro-Kiboga	Kyakabunga-Kiruhura	Nagojje-Mukono
Production system	Improved extensive	Traditional extensive	Improved extensive	Improved intensive
Limited access to good quality pesticides	√		√	
Flooding and continuous leaching of soils		√		
Limited access to land for planting especially for the youth			√	√
Lack of awareness on the commercial opportunities in forage production			√	√
Low milk prices which hinder investment in forages			√	

Farmers had different perceptions2 on forage production across all the production systems. The perceptions were assessed based on five statements and ranked using a Likert scale (i.e. 1=Strongly disagree, 2=disagree, 3=undecided, 4=agree and 5=strongly agree). The perceptions were expressed as percentages. The statements included:

1 It is important for farmers to receive training on fodder cultivation, fodder quality etc. provided by agri/ vet extension workers.

2 For my dairy farm, it is important for me to grow high-quality fodder/ forages.

3 It is necessary to supplement crop residues with high-quality fodder/forages.

4 It is easy for me to access quality planting materials for improved forages.

5 I'm willing to share information on improved forages with my peer farmers.

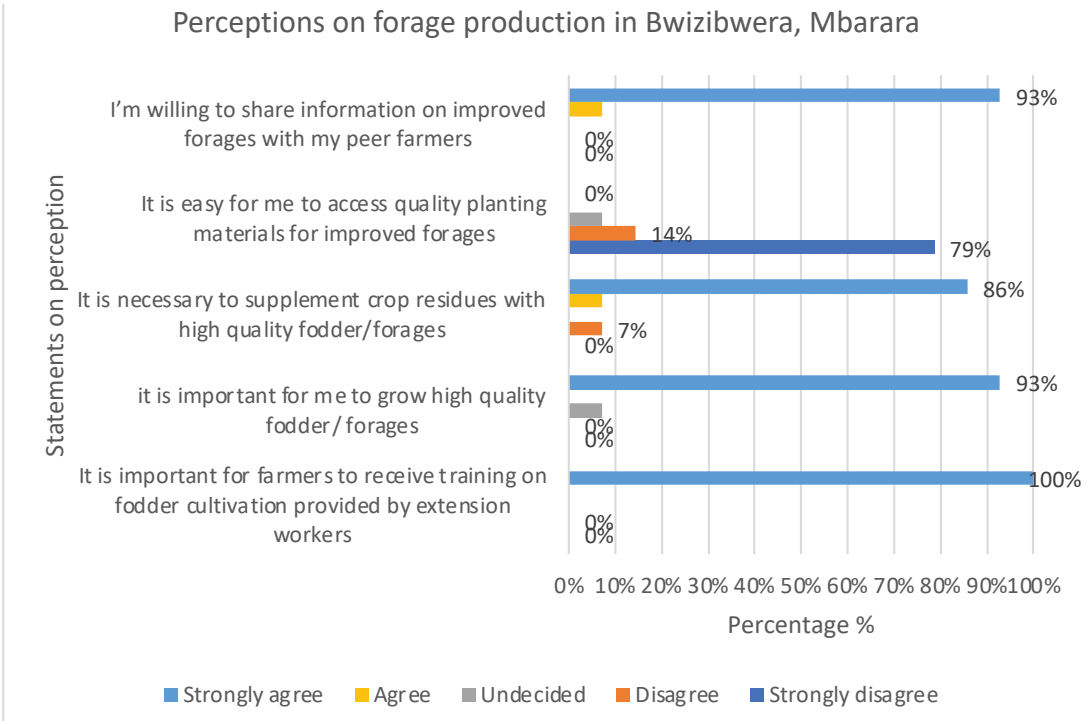
All the farmers present (100%) in Bwizibwera, Mbarara District, strongly agreed with statement 1 implying they value the importance of receiving training on different aspects of fodder management (Figure 6). Additionally, 93% of the respondents strongly agreed with statement 2 that growing high-quality fodder would improve on the nutrition of their animals thereby increasing milk production. However, a conservative 7% of farmers were undecided on statement 2 because to them, production of high-quality fodder would mean incurring extra costs, which they did not afford. There was a consensus on statement 3 (86% strongly agreed and 7% agreed) on the importance of feed supplementation of crop residue with high-quality fodder which contributes to farmer biodiversity and utilization of on-farm feed sources. On the other hand, there were farmers (7%) who disagreed with statement 3 and noted that some crop residues may be of poor quality and may not add nutritional value to the animal's diet.

Regarding statement 4 on access to quality planting materials of improved forages, most farmers have limited access to planting materials (79% strongly disagreed and 14% disagreed). The cost of seed is expensive and seed is largely unavailable in the area. Where it is available, seed quality is poor with farmers citing low germination rates.

Farmers in Bwizibwera were more willing to share information and learn more with other farmers regarding improved forages as shown by their perception score of 93% strongly agree and 7% agree. Information sharing among peers leads to diffusion of knowledge and technologies leading to high uptake of the technologies or innovations such as improved forages (Adesina and Baidu-Forson 1995; Maina et al. 2021).

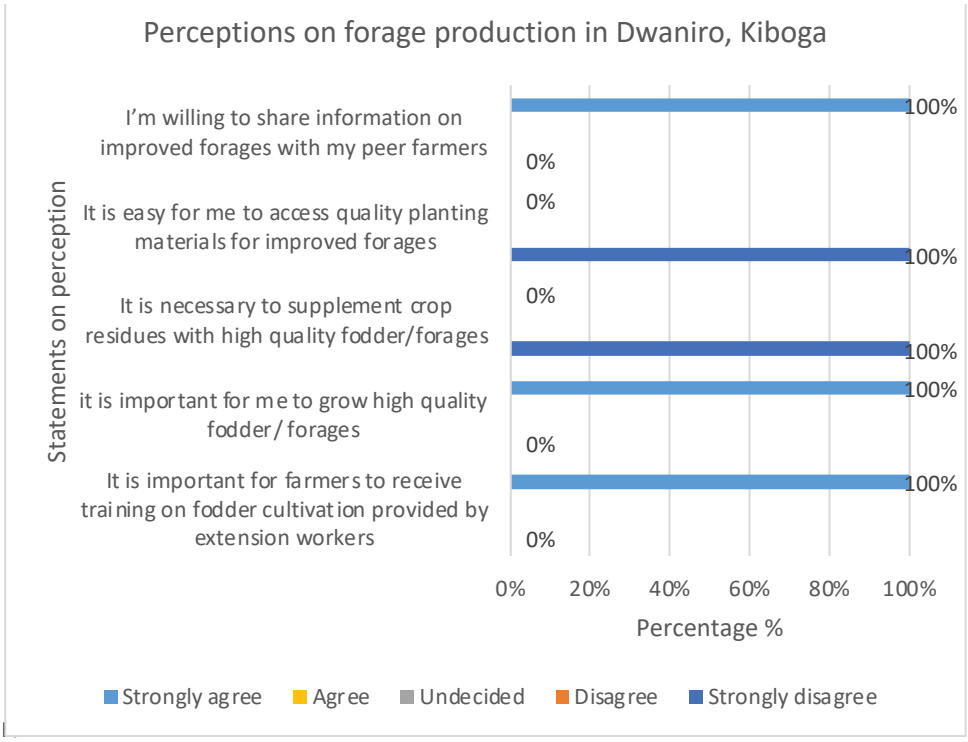
2 Perceptions are expressed as a percentage

Figure 6: Perceptions of farmers on forage production in Bwizibwera, Mbarara District.



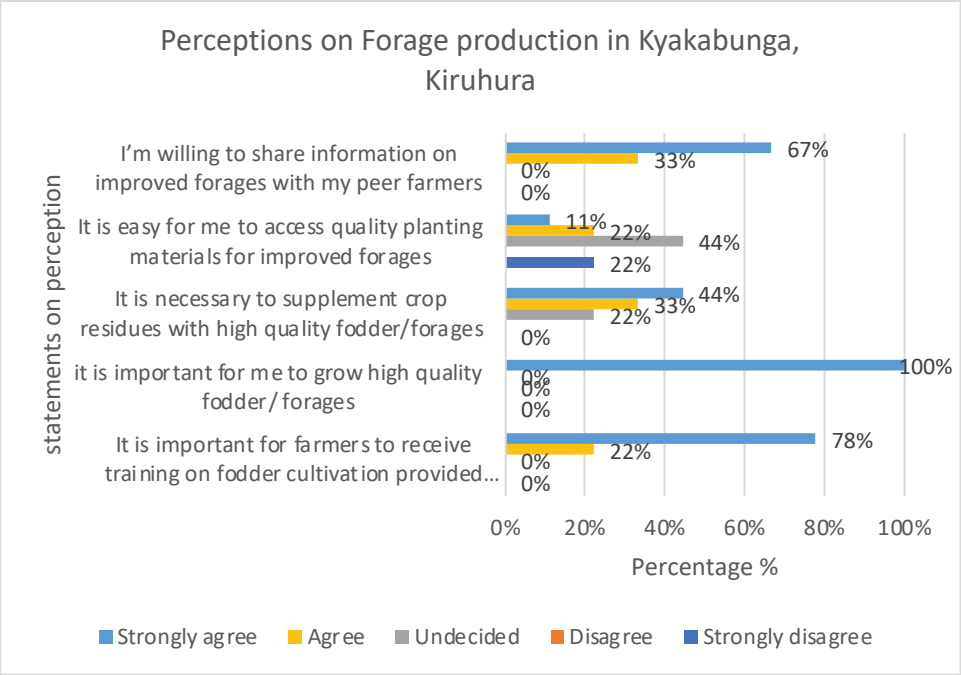
The farmers interviewed in Dwaniro, Kiboga District, strongly agreed (100%) with the statement on the importance of farmer training on improved forages and would be willing to share information on improved forages with their fellow farmers (100%). They value training as a source of knowledge and enrichment of skills in livestock production. Moreover, they highly regard the importance of planting high-quality improved forages as shown by the level of agreement with statement 2 (100%). However, all farmers strongly disagreed (100%) with the statement on the importance of supplementing crop residues with high-quality forages. This is probably because Dwaniro is predominantly a livestock production area that is characterized by grazing on natural occurring pasture as opposed to stall feeding and the cattle are of indigenous breed hence do not use crop residue as animal feed. Moreover, as observed in Mbarara, farmers have limited access to planting materials as they all strongly disagreed (100%) with the statement 'it is easy for me to access quality planting materials for improved forages' (Figure 7).

Figure 7: Perceptions of farmers on forage production in Dwaniro, Kiboga District.



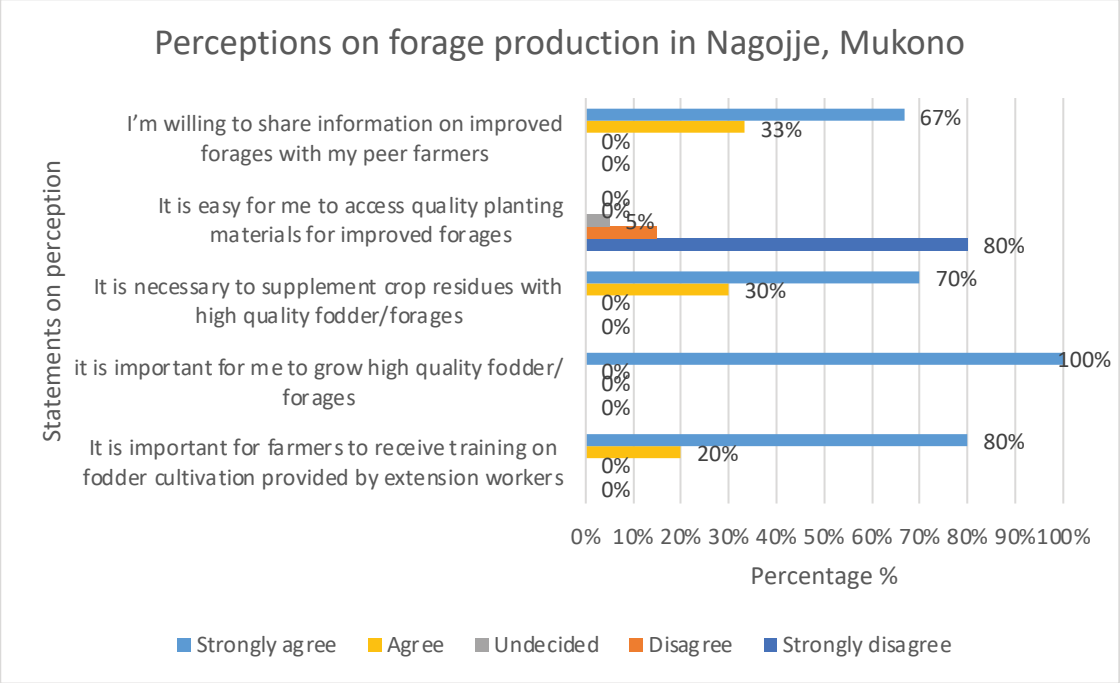
In Kyakabunga, Kiruhura District, farmers had various perceptions about improved forage production as shown in Figure 8. All the farmers interviewed valued the importance of receiving training on improved forage production (80% strongly agreed and 20% agreed) and are willing to share such information or training with their peer farmers. Moreover, they place high importance in growing of improved forages in improving the nutrition of their animals (100% of farmers strongly agreed). However, some farmers were undecided (21%) on the importance of supplementing crop residues with high-quality forage. Those that agreed with the statement on supplementation of crop residues considered the cost reduction on feeding by utilizing on-farm feed resources. On access to quality planting materials for improved forages, 22% of the respondents strongly disagreed with statement, while 44% were undecided. About 22% agreed and 11% strongly agreed implying they did not have difficulty in accessing planting materials locally. Nonetheless, many respondents remained constrained in accessing seed citing high cost and unavailability in the local agri stores.

Figure 8: Farmer perceptions on forage production in Kyakabunga, Kiruhura District.



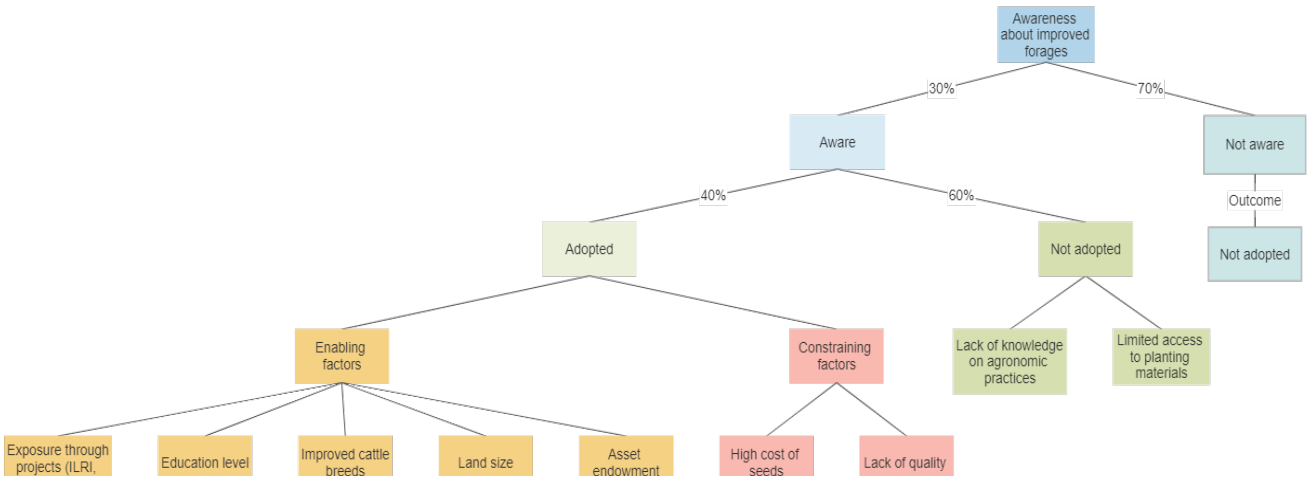
In Nagojje, Mukono District, farmers had various perceptions about improved forage production as shown in Figure 9. All the farmers interviewed valued the importance of receiving training on improved forage production (80% strongly agreed and 20% agreed) and were willing to share such information or training with their peer farmers. High importance was placed on growing improved forages to improve on the nutrition of animals (100% of farmers strongly agreed). The famers also agreed that it is important to supplement crop residues with high-quality forage. With regards to access to quality planting materials for improved forages, 22% of the respondents strongly disagreed with the statement, while 44% were undecided. However, many respondents remained constrained in accessing seed citing high cost and unavailability in the local agri stores.

Figure 9: Farmer perceptions on forage production in Nagojje, Mukono District.



The adoption of improved forages remains low across all the production systems due to lack of awareness regarding forage production among non-adopters (70%). Farmers that are aware (30%) may also not adopt due to lack of knowledge on agronomic practices and may have limited access to planting materials. For farmers who are aware (40%) are likely to adopt improved forages because of exposure through projects being implemented e.g. by ILRI, NaLIRRI and SNV; higher education level of the primary decision maker (on farming and livestock); owning improved breeds of cattle, higher land sizes and high asset endowment. Nevertheless, there are farmers who are aware and have adopted (60%) but continue to face challenges in the adoption process such as high cost of seeds and lack of quality seeds (Figure 10). Farmers have constantly lamented the low germination rates for some of the seeds that are sourced locally.

Figure 10: Decision tree on the adoption of improved forages by farmers.



Conclusion

In forage selection, Ugandan farmers consider the following key attributes that fit within their specific farming systems.

i Nutritional value of the forage

ii Adaptability of the forage to the climatic conditions within the area

iii Growth rate

iv Ease of use/preservability of the forage

v Yield capacity

vi Digestibility by the animals

For instance, farmers within traditional extensive production prefer improved forages that can be grazed such as Rhodes grass. Perhaps an emphasis should also be put on fodder conservation techniques such as baling when promoting such forages. In intensive and extensive improved systems, cut-and-carry forages that have high nutritional value and have a higher yield such as panicum and *Brachiaria* varieties would be more preferred by farmers. Therefore, in promotion of forages, stakeholders including seed companies should take into consideration farmers' intrinsic requirements that would drive them into adopting forages. This would contribute to better marketing and increased adoption rates of improved forages thereby translating to improved livestock productivity.

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