Characterisation of crop-livestock farming systems by improving feeding strategies in Rutsiro District, Western Province, Rwanda

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Summary

This study was conducted in Remera cell, Boneza sector, Rutsiro District in Western Province of Rwanda. The main objective was to characterize the crop-livestock farming system using the Feed Assessment Tool (FEAST). Focus group discussions (FGD) and individual farmer interviews were conducted with the aid of semi-structured questionnaires for data collection. The FDG involved a total of 15 participants comprising eight female and seven male farmers. In Rutsiro District, animals are kept under a zero-grazing system with cut and carry feeding method. The availability of feed in Rutsiro District is limited due to poor quality feeds, poor knowledge on using locally available feeds and climate change, leading to a shortage of feed for animals during droughts. The area has challenges in low genetic merit of dairy stock, water problems in the dry season, animal diseases and low milk prices.

Introduction

Rutsiro District is one of the seven districts located 150 km from Kigali and making up the Western Province. The altitude of the district varies between 1,400 metres at the edge of Lake Kivu and 2,600 metres beyond the top of Mount Crete at the Congo-Nile divide. It is located at -1°57'36" latitude and 29°23'22" longitude. This diversity offers the opportunity to grow a multitude of crops suitable for each climate zone. Farmers in Rutsiro District practice livestock farming with species such as cows and small ruminants (Table 1). Local breeds with very low productivity make up the majority of livestock kept by farmers.

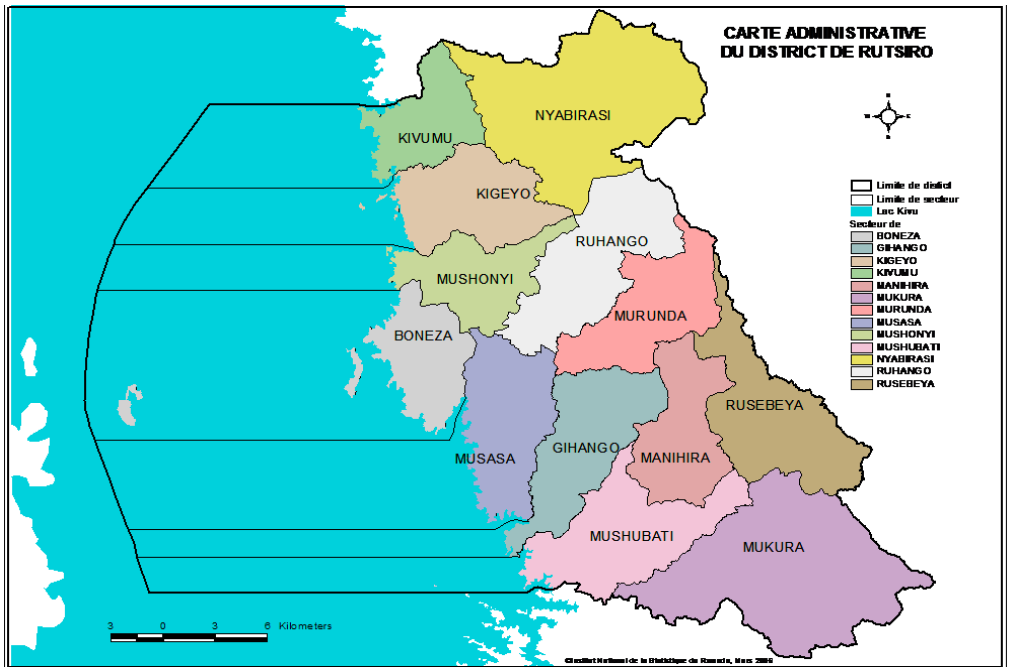
Table 1. Status of livestock in Rutsiro District

Year	Cows	Goats	Sheep	Pigs	Poultry	Rabbits
2008	20, 859	44, 743	26,167	8, 545	14, 143	29, 275
	14.5%	31.1%	18.2	6%	9.8%	20.4%
2012	48, 507	34, 532	31, 774	14, 126	36, 941	48, 144
	22.7%	16.1%	14.8%	0.7%	17.3%	22.5%

Source: Rutsiro District report 2012

The International Fund for Agricultural Development (IFAD) through RDDP has the objective to improve the livestock production system in 12 districts in Rwanda, Rutsiro being among the selected districts (Figure 1). Rutsiro was chosen due to its high livestock population density and potential to produce more milk.

Figure 1: Map of Rutsiro District



Currently, livestock production is one of the fastest growing agricultural sub-sectors, with extensive, semi-intensive and intensive systems of livestock farming all practised within the country. However, the availability of animal feed resources in the district varies greatly throughout the year both in quantity and quality. It is also highly dependent on climatic conditions, particularly rainfall and the length of the growing season. In addition, shortage of farmland, insufficient and non-controlled commercial feeds and limited use of agroindustrial by-products in animal feeding are common constraints in livestock production (MINAGRI 2012)[1].

The study was conducted in Rutsiro District, Boneza sector, Remera cell, by the Rwanda Dairy Development Project (RDDP) in collaboration with International Fund for Agricultural Development (IFAD) to assess the challenges that livestock farmers face and opportunities they have in the crop-livestock farming system using the Feed Assessment Tool (FEAST). It is anticipated that by the end of the RDDP, farmers will better organize in cooperatives, practise proper feeding of animals and supply enough milk to cooperatives.

1. MINAGRI (Ministry of Agriculture and Animal Resources). 2012. Strategy and investment plan for small animal industry in Rwanda. Kigali, Rwanda: MINAGRI.

Methodology

The assessment was conducted in the Remera cell from 11–15 February 2019. Remera cell was selected with the help of a sector veterinarian and socioeconomic development officer (SEDO) of a cell in Boneza sector. The FEAST methodology developed by researchers at ILRI was used. It involved conducting focus group discussions (FGD) with 15 participants (eight female and seven male) and subsequent individual interviews with nine farmers (three farmers each from the small, medium and large landholding categories). This was done to get farmers' inputs on local conditions, animal feed-related problems and potential solutions. Both exercises were conducted with the aid of semi-structured questionnaires and data was imputed into the FEAST data template and analysed. Results are presented in tables, graphs, and pie and bar charts.

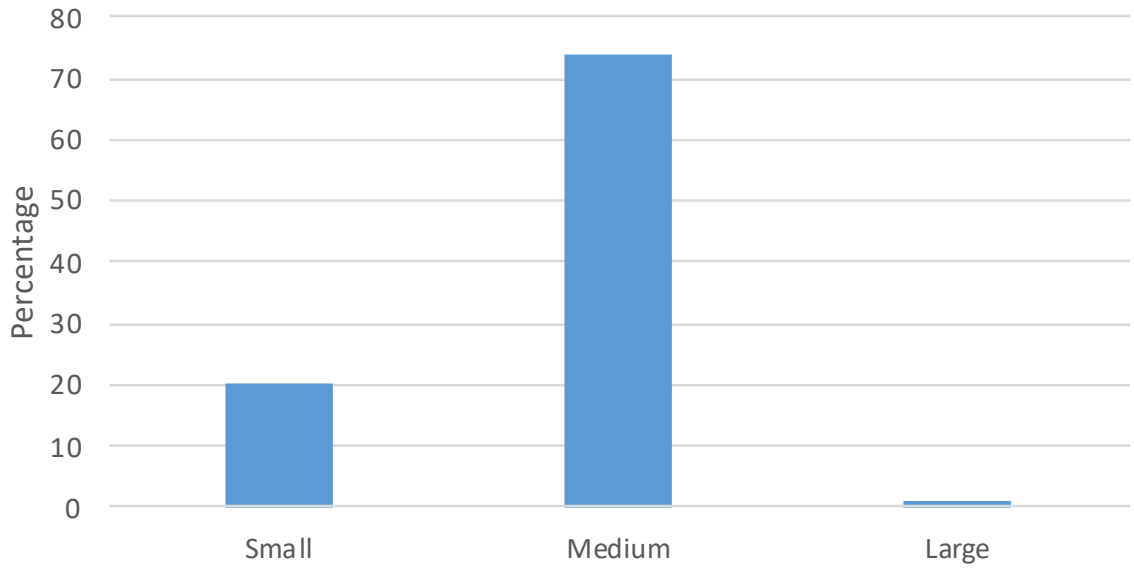
Figure 2: Focus group discussion with selected farmers

Results and discussion

Farming system

In both cells, the majority of farmers are classified as medium farmers with farm sizes ranging from 1–2 ha (74%). Large landholding farmers having more than 2 ha make up just 1% of the population while smallholder farmers with less than 1 ha make up about 20% of the population. About 5% of the population can be considered landless (Figure 3).

Figure 3: Landholding categories in Rutsiro District



Cropping seasons

In Rutsiro District, just like in most parts of Rwanda, there are three agricultural seasons (A, B and C) depending on rainfall patterns. The first season (A) is from September–December, the second season (B) from January–May and the third season (C) from June–mid-September. The longest season is B (5 months), followed by season A (4 months) and season C (3 months) (Table 2).

Table 2. Cropping system based on seasons throughout the year

Season	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec
A (short rains)												
B (longer rains)												
C (dry season)												

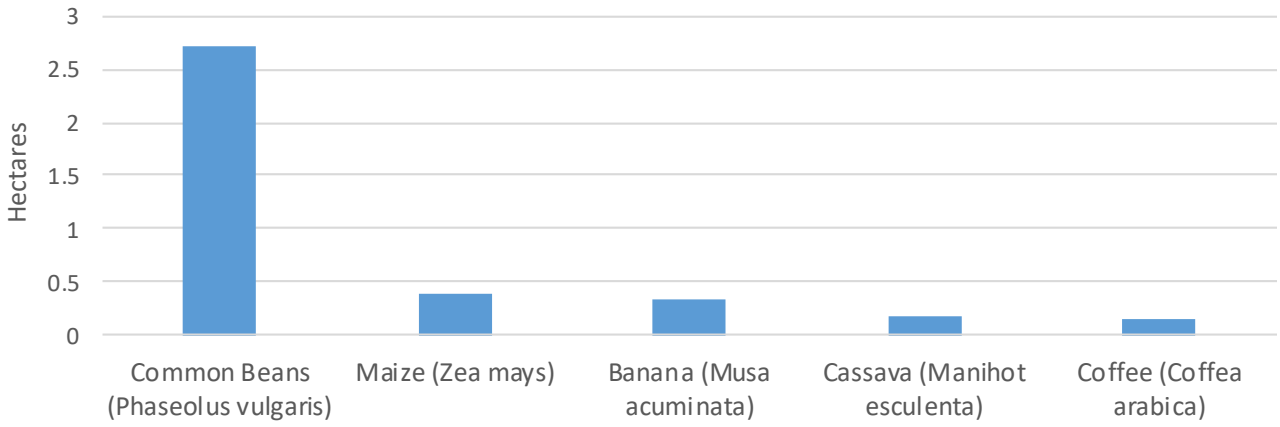
Sources of water

The main sources of water in the district are Lake Kivu, rain and tap water. Lake water is available throughout the year while rainwater is available during the rainy seasons. Due to distance, Lake Kivu supplies only about 1% of the water needs of livestock and most farmers depend on rain and tap water to meet the water requirements of their animals. Farmers do not practise rainwater harvesting.

Crop production practices

Crops that are grown in season A include banana, coffee, maize, common beans, cassava and soybean. In season B, soybean, common beans, maize, banana, cassava and coffee are cultivated. In season C, crops grown are mainly vegetables, sweet potato and yam in marshy or riverine areas (Table 2). The five most important crops by area cultivated are common beans, maize, banana, cassava and coffee (Figure 4).

Figure 4: Dominant crop types by average hectares cultivated



Forage cultivation

The main forage crops grown in the area are Napier grass *(Pennisetum purpureum)* and Kikuyu grass *(Pennisetum clandestenum)* on an average of 0.075 ha and 0.025 ha respectively.

Type of credit for livestock and cropping activities

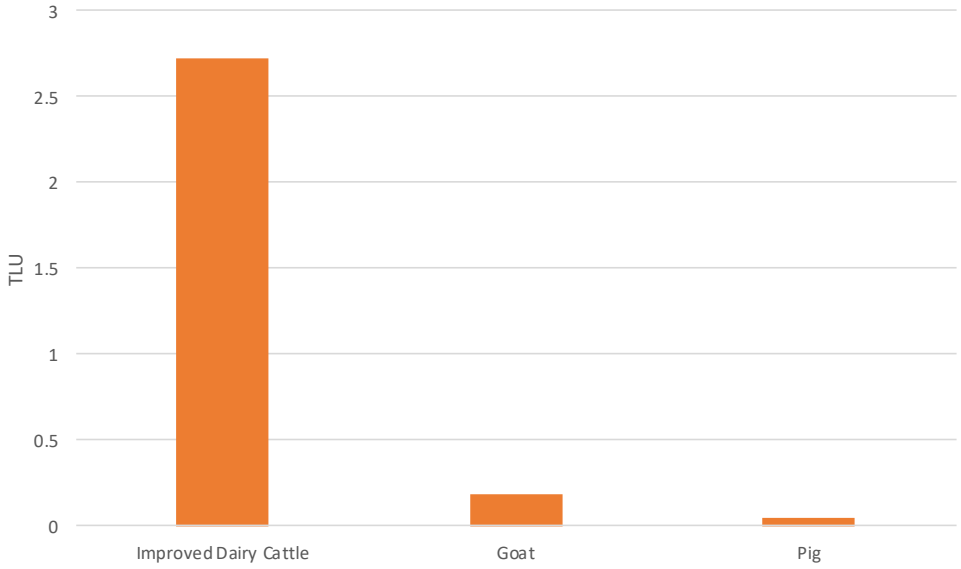
The sources of credit are the same across all cropping seasons. The most important sources of credit in the area are saving and credit cooperatives (SACCOs) and informal groups which cover 95% of the total credit provided. Credit from formal markets accounts for just 5%. Credit is mostly sourced for agricultural activities during seasons A and B. Farmers require some form of collateral to access credits from the informal credit markets. This may include providing some form of property as collateral or another group member staking his or her savings.

Livestock production

Farmers own various livestock species which include improved cattle (crossbreed of Friesian cows), goats and pigs (Figure 5). Animals are kept for various purposes. Cattle are primarily raised for milk, manure and cash income while goats are raised mainly for cash. In the surveyed area, most farmers in medium and large farm categories keep on

average one to two heads of improved cattle (crossbreed of Friesian cows) (2.73 TLU). Most farmers in the small landholding category who also keep cattle received their cattle from the Girinka program (cattle given to poor families) to fight against malnutrition within smallholder farmer communities.

Figure 5: Dominant livestock categories by average TLUs/household



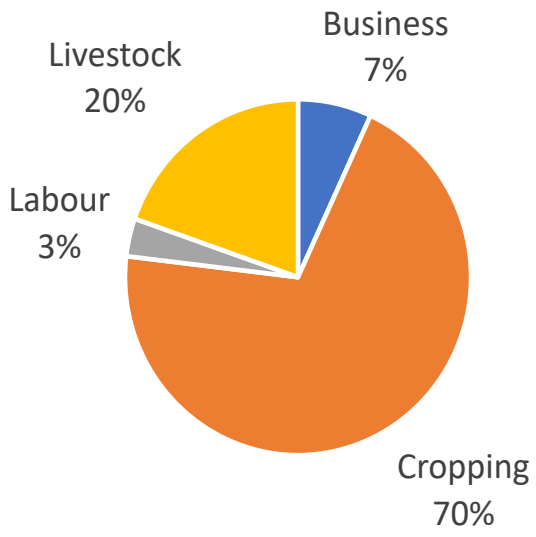
Labour

The average daily labour rate ranges between FRw600–1000[2] and depends on activity, gender and season. Duties like ploughing and harvesting are shared among both genders and are paid equally. Predominant male activities include manure transportation and milking while weeding crops and cleaning of cowsheds are mainly done by females.

Sources of income

Agriculture constitutes the major source of household income with food crops contributing the most (70%) followed by livestock (20%). Off-farm income accounts for just about 7% of the household income (Figure 6).

Figure6: Average household income by activity



2. USD1=FRw890

Livestock management

Most households practise a semi-intensive livestock production system. Feeding troughs are constructed with wood, the floor is cemented and bedding is provided. Animals are housed together according to species, sex and type, except dairy calves which are separated from the cows. Zero-grazing is practised by most of the farmers with seasonal variation hardly influencing the feeding method. Feed particle size is reduced by manual chopping of collected fodder (Napier grass and crop residues) with traditional machetes (panga). Based on gender, farmers involved in feed processing are 60% male and 40% female. In Rutsiro, the important diseases affecting animals are East Coast fever (ECF), Dystocia and Anaplasmosis. The different types of animal health care services available to the farmers are presented in Table 3.

Table 3. Different types of animal health care services available to the farmers

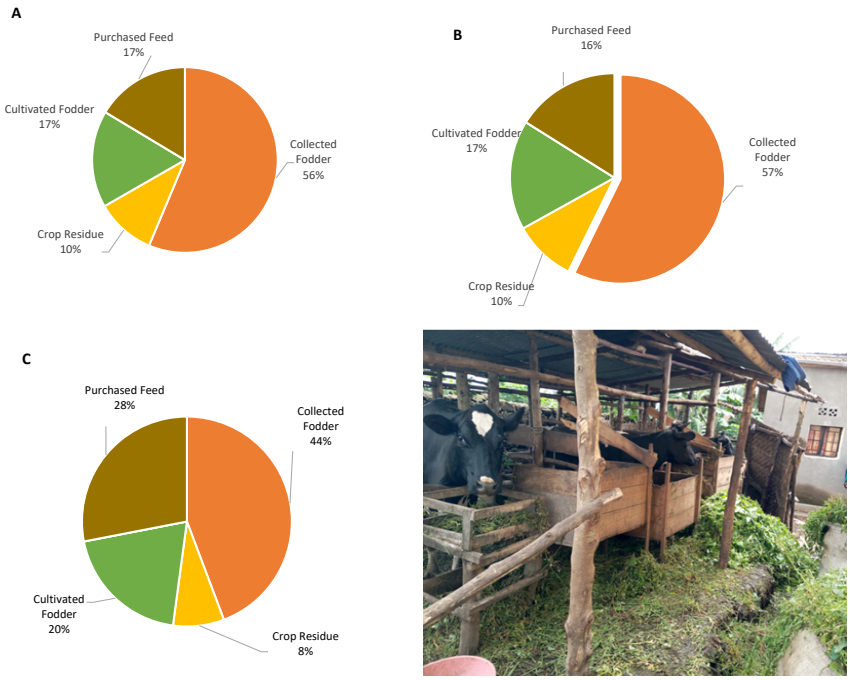
No.	Type of service	Service providers	Cost
1	Sale of veterinary drugs/animal treatment	Government animal resource officers and private veterinary service providers	From FRw30,000–70,000
2	Vaccination	Government animal resource officers and private veterinary service providers	FRw3000
3	Artificial insemination	Government animal resource officers and private veterinary service providers	FRw5000
4	Assistance in parturition	Government animal resource officers and private veterinary service providers	From FRw5000–20,000

The cost of service depends on the nature of the service provided and farmers reported using mostly (95%) natural bull services.

Major feed resources

Collected fodder accounted for the highest proportion (44–57 %) of livestock diets in Rutsiro in terms of dry matter (DM), metabolizable energy (ME) and crude protein (CP) (Figure 7). Cultivated fodder (17–20%) and purchased feed (16–28%) also contribute significantly to the dietary requirements of livestock in Rutsiro District. On average, crop residues account for less than 10% of diets for livestock while grazing is not a common feed resource.

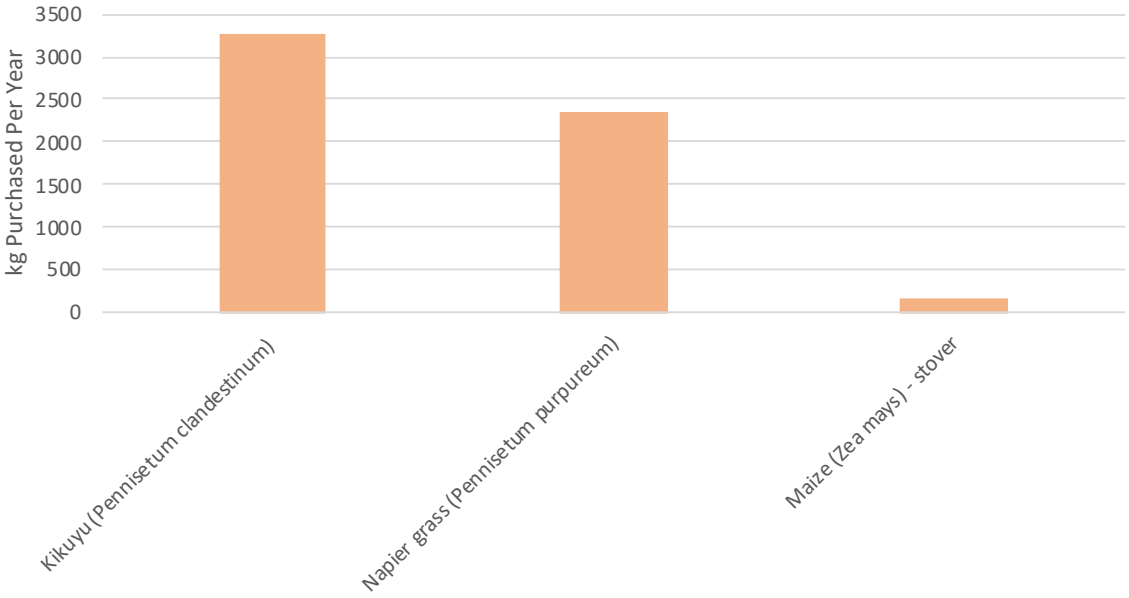
Figure 7: Contributions of 5A dry matter (DM); 5B metabolizable energy (ME); 5C crude protein (CP) to dietary requirements in the study area; and 5D: animals in zero-grazing system



Various feed types purchased and the quantity

Farmers reported purchasing mostly Kikuyu grass (*Pennisetum clandestinum*) and Napier grass (*Pennisetum purpureum*) fodder to feed their animals (Figure 8). Also, farmers in Rutsiro purchase grain residues from breweries at an average of about 16 kg per household per year. Mineral blocks are purchased in small quantities at an average of 3.6 kg per year.

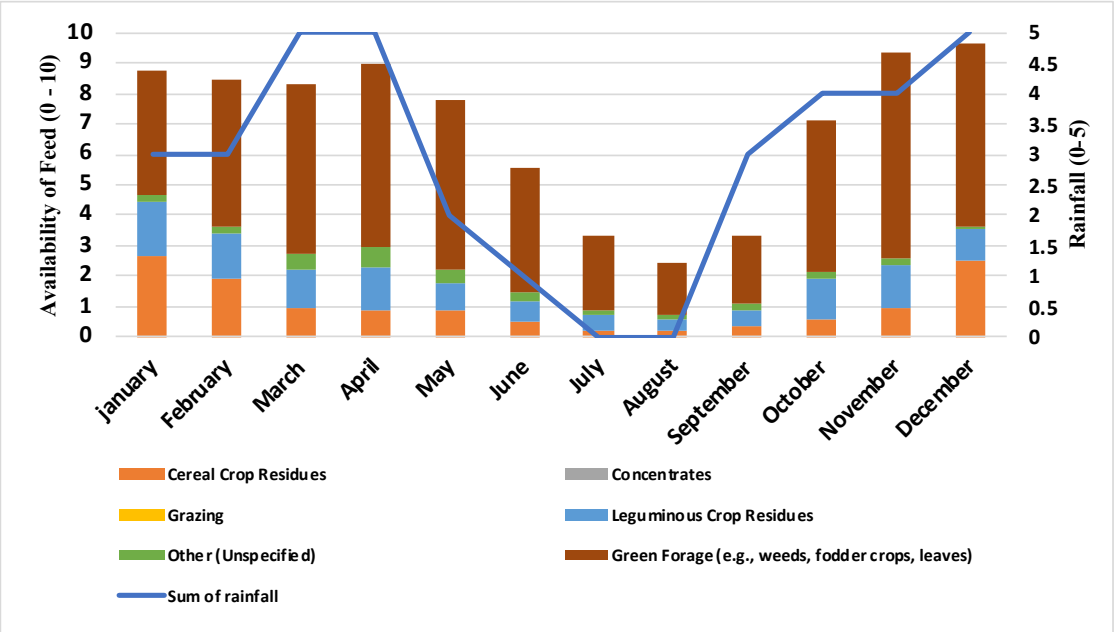
Figure 8: Different feed types purchased and the quantity



Rainfall and feed availability

The seasonal fluctuation of rainfall leads to low feed availability in quantity and quality, especially during the dry season. The highest rainfall months are March/April and November/December while the lowest is July/August. Farmers rely on green forage like Kikuyu grass (*Pennisetum clandestinum*) and Napier grass (*Pennisetum purpureum*) almost all year round. Cereal and leguminous crop residues are also available after the harvest season.

Figure 9: Rainfall and feed availability throughout the year



Key challenges and suggested interventions

A pair-wise ranking exercise was conducted to identify the five most important livestock problems farmers face in Rutsiro. The result of the pair-wise ranking is shown in Table 4.

Table 4. Major problems faced by farmers and proposed solutions

Rank	Challenges	Suggested interventions by farmers
1	Lack of improved breed	• Provision of quality breed bulls in the area • Subsidize AI services
2	Low quantity and quality feeds	• Provision of quality forage varieties adaptable to the agroecological zone • Training on fodder conservation and animal ration formulation • Farmers' cooperative formation to facilitate the access on concentrates feed
3	Lack of water for watering animals	• Subsidized water containers (plastic tanks) • Training on rainwater harvesting
4	Animal diseases	• Training on biosecurity measures • Training on animal welfare • Encouraging the establishment of both government and private vets in the area • Establishing veterinary pharmacy
5	Low milk price compared to the cost of milk production	• Increase milk collection centres in the area • Conduct sensitization and awareness campaigns on the need and importance of milk consumption • Encourage more investment by the private sector in raw milk processing

There is abundant availability of water in the area from Lake Kivu and rain catchment water and rivers that feed Lake Kivu. Tap water is used by few farmers due to high cost of investment. The availability of water from different sources can be utilized throughout the year. However, distance is a constraint. There is lack of cultivated green forages in terms of quantity and quality to feed their animals. However, farmers in the area continue to rely heavily on collected fodder which is not a sustainable source of feed for livestock. Below are some suggested solutions that can potentially mitigate some of the major problems identified by farmers. An intervention analysis report is also given in Table 5.

- Irrigated fodder production (grasses, maize and sorghum) and grasses for cut and carry systems (cut from cultivated fodder field).

- Optimal use of various types of feeds and crop residues, supplementing with agroindustrial by-products, molasses and dairy concentrates to mitigate low quality and quantity of forage in the dry season. The least cost ration based on available local feeds resources should be formulated, tested, validated and promoted in the area.
- Plant leguminous forage shrubs to provide browse. Also, grass splits into ridges and intercropping forages such as Lablab in mixed farming with crops for cut and carry systems, as well as the growth of annual fodder crops such as oats, vetch, maize and sorghum should be promoted through extension services to farmers.
- Supplementation with energy-rich supplements, e.g. molasses and the use of protein by-products, e.g. meat, blood and bone, fish, and legume leaf meals, as well as biofuel co-products, oilseeds and poultry litter are all recommended in the area.

Table 5. Intervention analysis report (scores out of 20)

Key interventions	Mitigate core constraint	Relevance to commodity	Relevance to farm system	Match context attributes	Production impact
Cereal by-products (rice bran, maize, wheat, etc.)	13	20	20	15	20
Waste from distilleries and breweries (local and industrial)	13	20	20	18	15
Supplementation with energy rich supplements, e.g. molasses	15	20	20	15	20
Supplementation using protein by-products, e.g. meat, blood and bone, fish, legume leaf meal, biofuel co-products, oilseeds, poultry litter, etc.	15	20	20	15	20
Use of commercial balanced compounded feeds (e.g. dairy meal)	18	20	15	15	20

Key issues

- Limited AI services to improve dairy cattle breeds
- Animal diseases cause mortalities and loss of production
- Water scarcity during the dry season
- Lack of feed resources in quantity and quality
- Milk price is a constraint to milk production

Ways forward

- Backyard intensification to utilize available resources (land, water and labour) efficiently. This would include the planting of high-quality leguminous forages such as perennial crops, leguminous forage trees, hedgerows and fences.
- Optimizing the use of locally available feed resources including cultivated forage, collected fodder and crop residues through optimal mixing practices and supplementary feeding of concentrates.
- Establishing concentrate sales points in the area.

Conclusion

The farming system in Rutsiro District is primarily dominated by a subsistence-based mixed farming system.

- Farmers perceive that the low genetic potential of available dairy cows for milk production, low quantity and quality of feeds and lack of enough water for watering animals (especially during the dry season) are major constraints to livestock production.
- Lack of enough capital to invest in water harvesting facilities, coupled with inadequate experience and skills on water harvesting, are some of the contributing factors.
- Animal feed availability in both quantity and quality is one of the most important problems faced by farmers. This problem is caused by limited land to grow forage crops due to very high population density.
- Low milk production and productivity of cows was attributed to poor quality and quantity feeds and low genetic merit of dairy stock kept by farmers.

Recommendations

- Introduce appropriate water harvesting and utilization technologies for multiple purposes including water for livestock and backyard forage production.
- Identify niches to integrate high-quality leguminous forages, grasses and fodder trees in the cropping system.
- Design and test optimal ration options for farmers using collected fodder, cultivated fodder and crop residues.
- Target farmers with large landholding to produce forages as cash crops.
- Farmer cooperatives should organize and do bulk purchases of feeds and distribute to other members in the area.
- Upgrade local cows with improved AI service delivery by promoting private AI practitioners so that animals respond to improved nutrition and management.

Annexes

Annexe 1: Key livestock statistics

Offtake of cattle (%)	4	%	TLU cattle sold or slaughtered in the past 3 years/ (3*total cattle TLU)
Offtake of sheep and goats (%)	7	%	TLU shoat sold or slaughtered past 3 years/(3*total shoat TLU)
Average annual income from milk sales	76,721.28	In FRw	Sum of (average daily milk sales (USD) by month X days in a month) for all 12 months
Average price received for milk throughout the year	84.69	FRw	Monthly average price milk/litre in local currency
Average price received for milk throughout the year	0.12	In USD	Monthly average price milk/litre in USD
The total amount of milk retained throughout the year	1,314.180556	Litres per household	(Average milk retained for household use for January X 31) + (average milk retained for household use for February X 28), etc.
Percentage of milk sold	40	%	(Total amount of milk produced per year –total amount of milk retained throughout the year)/total amount of milk retained throughout the year)*100
Average production per female dairy animal per day	2.28	Litres/cow/day	The total amount of milk produced per year/(sum of TLU of female dairy cattle)/365
Average production per lactating dairy animal per day	4.21	litres/cow	C8/(sum of TLU of female lactating cattle)/365
DM amount (kg) of total diet per household	7,301.257	kg	Sum of DM from different diet components (from contributions table)
ME amount (MJ) of total diet per household	71,807.511	MJ	Sum of ME from different diet components (from contributions table)/1000
CP amount of total diet (kg) per household	743.170	kg	Sum of CP from different diet components (from contributions table)/1000

CP: ME ratio	10.349	g CP/MJ	Total CP/total ME
Milk yield per MJ and ME	0.031	litres/MJ	The total amount of milk produced per year/total ME
Total crop area per household (ha/household)	3.970444444	ha	The grand total from "crop cultivation" graph
Total forage area per household (ha/household)	0.095	ha	The grand total from the "fodder cultivation" graph
CR yield per ha (=total CR DM/total crop area)	190.80	kg DM/ha	DM from crop residue/total crop area
Forage yield per ha (=total forage DM/total forage area)	12,994.67	kg DM/ha	DM from forage crops/total forage area
Forage crop area as a percentage of cropped area	2	%	Total forage area/(total forage area + total crop area)