Characterisation of livestock production systems and identifying potential feed interventions for increasing dairy productivity in Nyagatare district, eastern Rwanda

Joseph Nshokeyinka[1], Albert Manishimwe[2], Evalde Kagwa[2], Rugamba Maurice[1], Vincent Niyiragira[1] and Ben Lukuyu[3]

1. Single Project Implementation unit of IFAD Funded Projects/RDDP
2. Rwanda Agriculture and Animal Resources Development Board
3. International Livestock Research Institute

June 2019


UNIVERSITY of RWANDA


RAB
RWANDA
AGRICULTURE AND ANIMAL RESOURCES DEVELOPMENT BOARD


IFAD
Investing in rural people

ILRI thanks all donors and organizations which globally support its work through their contributions to the CGIAR Trust Fund.

Editing, design and layout—ILRI Editorial and Publishing Services, Addis Ababa, Ethiopia.

Citation: Nshokeyinka, J., Manishimwe, A., Kagwa, E,. Maurice, R., Niyiragira,V. and Lukuyu, B. 2019. *Characterisation of livestock production systems and identifying potential feed interventions for increasing dairy productivity in Nyagatare district, eastern Rwanda.* Nairobi, Kenya: ILRI.

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

ILRI has offices in East Africa • South Asia • Southeast and East Asia • Southern Africa • West Africa

Contents

Tables

Figures

Acknowledgements

We extend our acknowledgement to International Fund for Agricultural Development (IFAD) and the Government of Rwanda who funded the Feed Assessment Tool (FEAST) training through Rwanda Dairy Development Project (RDDP). We acknowledge the collaboration, support and contribution of all respondents and local government livestock agents for their facilitation during data collection. Our acknowledgement also goes out to Alan Duncan, Ben Lukuyu and Derseh Melkamu for their commitment during the training and review of the FEAST reports. We also take this opportunity to thank Rwanda Agriculture and Animal Resources Development Board and the University of Rwanda for having accepted to avail their staff to contribute to this work.

Summary

The Feed Assessment Tool (FEAST) was applied to characterize livestock production systems and identify potential feed interventions for increasing dairy productivity in Gacundezi Cell of Nyagatare district in eastern Rwanda.

The assessment comprised a focus group discussion (FGD) with 16 participants (7 female and 9 male) followed by individual interviews (with 9 out of the 16 farmer representatives from the FGD, selected to have three farmers from each of the three landholding categories (small, medium and large) following classification of.

Grazing is the predominant livestock feeding system, while cattle and goats are the main species reared by the farmers.

Farmers identified insufficient improved forage/fodder varieties for forage production among the key challenges. On a scale of importance, lack of water, milk market and marketing issues, diseases, feeds and feeding issues, and insufficient livestock inputs are the main problems hindering livestock production in Gacundezi Cell. Feed issues have been correlated with lack of knowledge/skills on forage establishment, pasture improvement and management, harvesting, forage conservation and utilization. The identified feed interventions include (i) rainwater harvesting for livestock watering, (ii) improvement of pastures, (iii) promoting commercial forage production, (iv) promoting supplementation of the basal diet of animals with energy-rich supplements and protein source feeds.

1. Introduction

Most Rwandans depend on agriculture and livestock activities for their livelihood. According to the 2017 Agriculture Household Survey (AHS) carried out between September 2016 and June 2017, Rwanda has an estimated 2.1 million agricultural households (NISR 2017). These make up about 80.2% of the total estimated households of the country. The results of the survey also indicate that 78.6% of all households in Rwanda were engaged in crop production, whereas 62.6% of households engaged in livestock production.

This shows that the livestock subsector has demonstrated the potential to be a reliable source of income and improvement for the livelihoods of livestock owners and other value chain actors. Rwanda has recently introduced cattle with improved genetics aiming to increase milk production and productivity. However, low feed availability in quantity and quality is a major constraint to increase livestock productivity for many dairy farmers. Specifically, dairy farmers of Nyagatare district in eastern Rwanda are also experiencing a shortfall in animal feed availability all year round leading to decreased milk productivity of their cows.

Special interventions are required to solve the challenge in animal feeding. In this context, the Government of Rwanda signed a financing agreement with IFAD to finance the Rwanda Dairy Development Project (RDDP) for the period from 2017–2022. This project was contracted by the Ministry of Agriculture and Animal Resources (MINAGRI) and directly implemented by the Rwandan Agriculture and Animal Resources Board (RAB). The project operates in 12 districts in eastern Rwanda.

The overall goal of RDDP is to contribute to pro-poor national economic growth and improve the livelihood of resource-poor rural households. Specifically, the project seeks to increase competitiveness and profitability of the dairy sector for the provision of quality products from small-scale producers to domestic and regional consumers, thus improving their livelihoods, food security and nutrition whilst building overall resilience.

Table 1. Characteristics of the study area

Size of the district (km2)	Estimated population (NISR 2012)	District borders	Annual rainfall	Annual average temperature
1,741	465,885	Uganda in the north, Tanzania in the east, Gatsibo district of the eastern province in the south and Gicumbi district of the northern province in the west	827 mm	25.3–27.7°C

The annual rainfall is very unpredictable to satisfy the needs of farmers in crop-livestock integrated systems of this area.

2. Methodology

FEAST, developed by researchers at the International Livestock Research Institute (ILRI), is a systematic method to assess local animal feed resource availability and use (Duncan 2012). It was implemented in Gacundezi Cell of Rwimiyaga Sector in Nyagatare district on 11 February 2019.

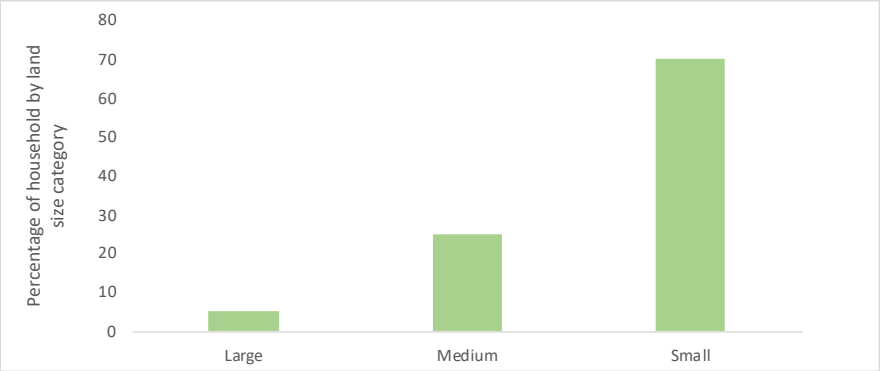
With the support of the sector animal resources officer, 16 participants (7 females and 9 males) were selected for the FGD (ILRI 2015a) and subsequently, 9 out of the 16 farmers were selected for one-on-one interviews (ILRI 2015b). The nine farmers selected for the individual interviews were drawn to have three from each of the landholding categories (small, medium and large as determined by farmers). The site coordinates (longitude and latitude) were taken and recorded by using GPS. The information provided by farmers from the FGD and individual interviews was entered into FEAST (https://www.ilri.org/feast) excel template and analyzed. Results are presented in tables, graphs, pie and bar charts.

3. Results

3.1 Farming systems

The majority of farmers (70%) are in small landholding category (0.1–0.5 ha) while 25% fall in medium land category (0.5–2.5 ha) and only 5% of the farmers belong to the large land category (above 5 ha of land) (Figure 1).

Figure 1. Distribution of land area cultivated by households in different landholding categories



3.2 Livestock production systems

Various farming systems are practiced by the farmers in the study site. These include extensive, year-round grazing of animals on rangelands, semi intensive production with combined grazing, stall feeding and zero grazing systems using mainly cut-and-carry forage. The type of system used was reported by farmers to be dependent on the size of the farm and the number of animals owned by the farmer. Farmers who have many animals prefer the extensive grazing option.

Livestock holdings per household

Most households in the area keep improved dairy cattle with on average of 17.6 TLUs/household, while local dairy cattle only comprise 0.13 TLUs (Figure 2). Goats, sheep and local poultry are kept by farmers in the study site in fewer numbers. These findings clearly indicate that there is a trend towards keeping improved dairy cattle by farmers (Figure 3).

Figure 2. Average household livestock holdings by category in TLUs

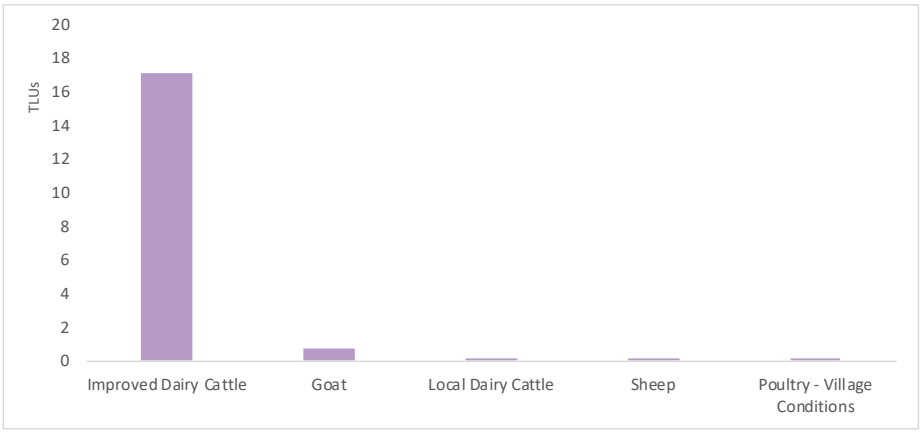
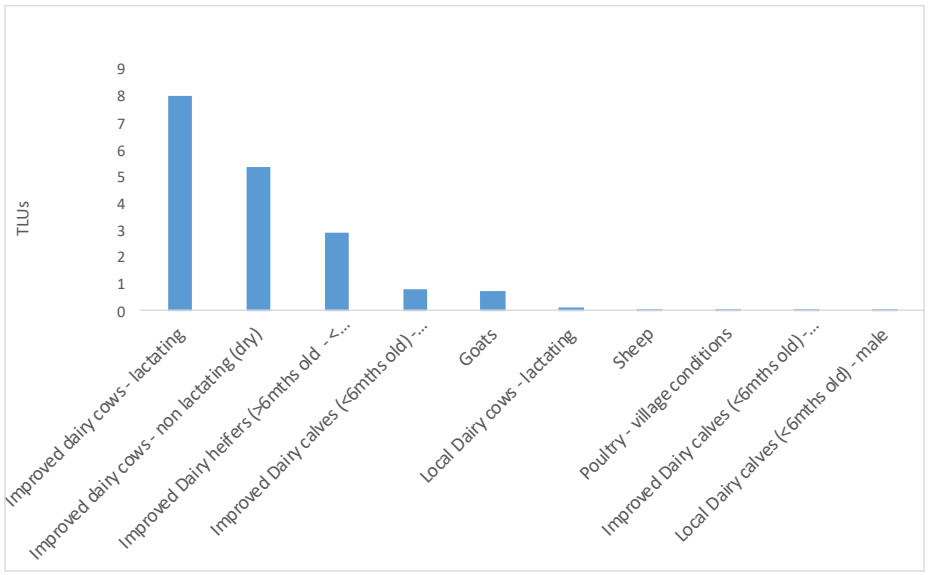


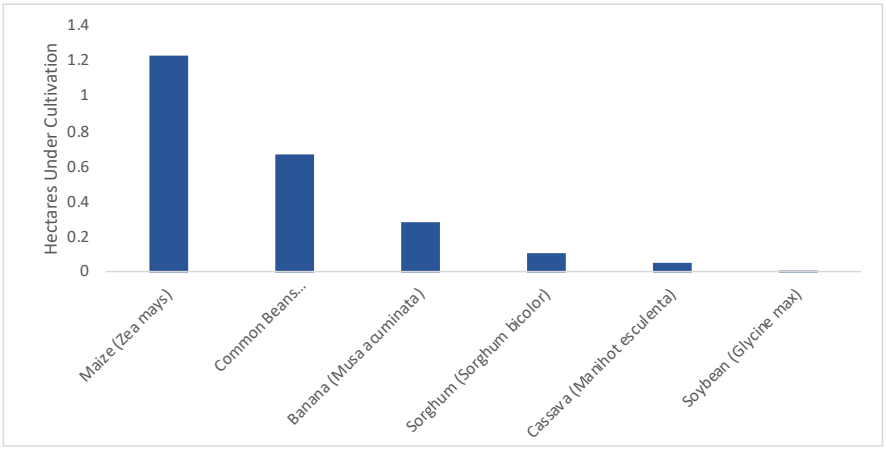
Figure 3. Average livestock heads per household by farm size



3.3 Crop production

The dominant crop types cultivated on average hectare basis and in descending importance in the study site are maize, common beans, bananas, sorghum, cassava and soybean (Figure 4). Farmers practice mixed cropping mainly between maize and common beans.

Figure 4. Average land size allocated for different crops grown by individual households



Cropping seasons in Nyagatare district

There are three cropping seasons in Nyagatare—season A (October–February of the following year), season B (March–June), and season C (July–September). See Table 2.

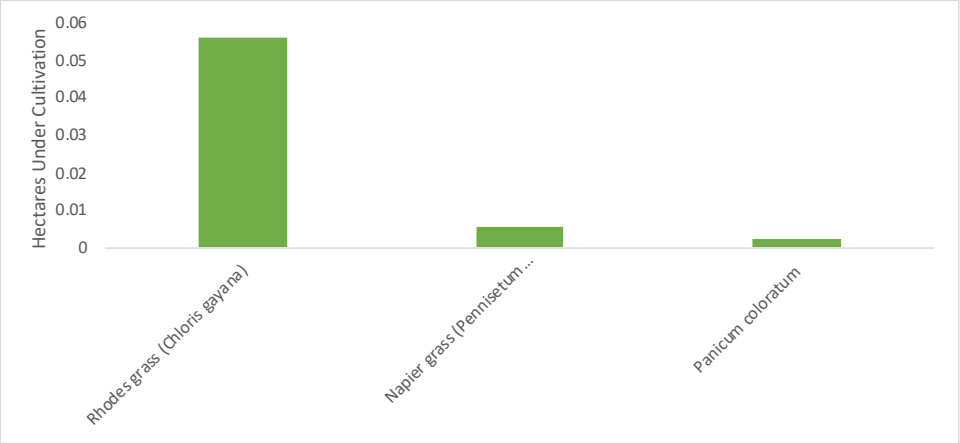
Table 2. Cropping seasons in Gacundezi Cell

Name of season	Jan	Feb	March	Apr	May	Jun	July	Aug	Sept	Oct	Nov	Dec
Season A	x	x								x	x	x
Season B			x	x	X	x						
Season C							x	x	x			

3.4 Forage production

Farmers grow forage crops on relatively small land sizes compared to other crops. The average land area set aside per household for forage crop cultivation stands at 0.063 ha. From this, *Chloris gayana* is cultivated on 0.055 ha, *Pennisetum purpureum* on 0.005 ha, and *Panicum coloratum* on 0.002 ha (Figure 5), indicating a very small contribution of planted forages to the feed resource base.

Figure 5. Average hectares cultivated per household by fodder crop type



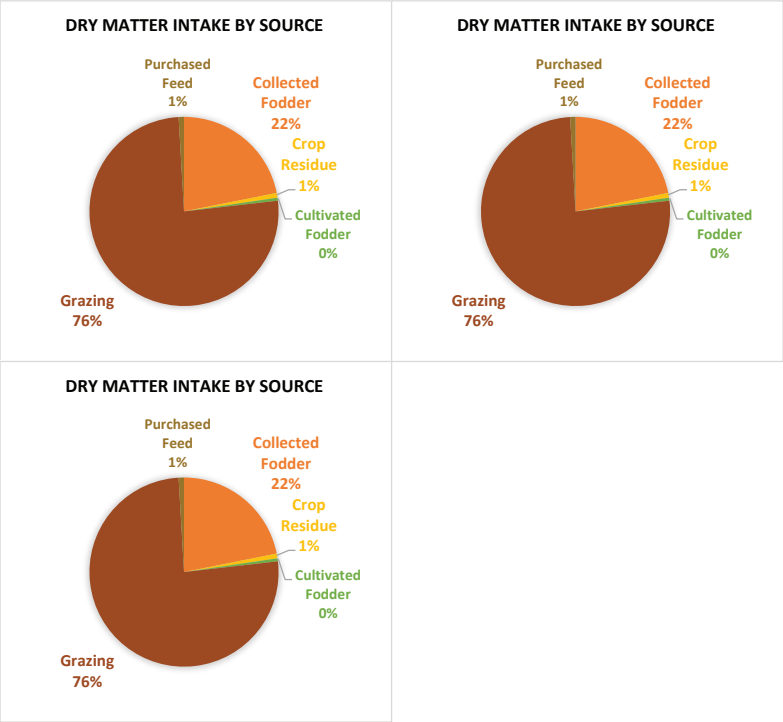
3.5 Purchased feeds

Farmers in the study site purchase mainly two types of feeds—rice bran and maize bran. On an annual basis, an average of 900 kg and 600 kg of rice bran and maize bran respectively are purchased by farmers. This is mostly done in the dry season (July, August and early September) and points to relatively low level of utilization of compounded feeds for livestock production in the study area.

3.6 Contribution of various feed resources to dietary requirements of livestock

Grazing contributes most significantly (over 75%) to the dry matter (DM), metabolisable energy (ME) and crude protein (CP) intake of livestock in the study site (Figure 8). Collected fodder comes in second position with contributions ranging between 21–24% of intake for the three nutrient categories, while purchased feed, cultivated fodder and crop residues make very little contribution.

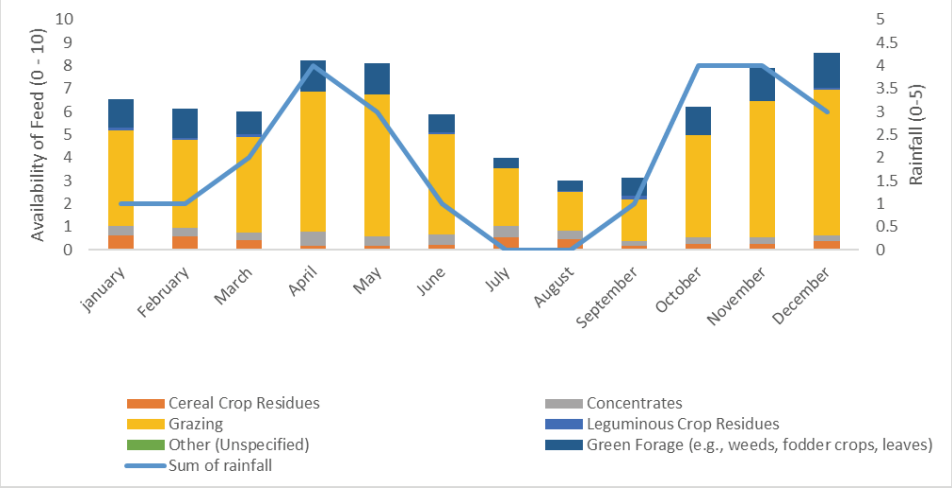
Figure 6. Contribution of different feed sources to the dry matter, crude protein and metabolizable energy intake of livestock



3.7 Availability of feed resources during the year

Most farmers in Gacundezi graze their animals on pastures throughout the year. This explains the dependence of farmers on rainfall to have sufficient forage for their animals and the seasonality in the availability of forage for animals. Therefore, forage availability correlates with rainfall, peaking in April, May, November and December with the rains and dipping in July and August with the dry season (Figure 7). This same pattern is observed with green forages. Crop residue is used during the dry season.

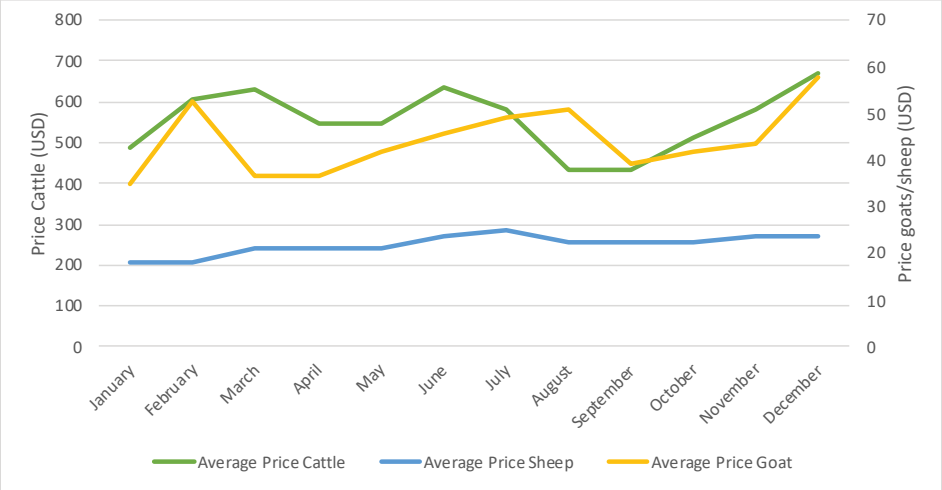
Figure 7. Availability of feed resources and rainfall pattern during the year



3.8 The price of major livestock species in Gacundezi area

The average price of various livestock species fluctuate throughout the year (Figure 8). Prices are highest for cattle in December due to the preparations for end of year festivities, and lowest during the dry season months of August, September and January. Farmers associated this drop in prices in January to the high numbers of cattle present in the market due to the increased supply from December. The average price for goats follows almost a similar pattern to that of cattle with noticeable peaks in December and February. Farmers reported similar reasons as for cattle to explain the peaks. For the dip in price noticed in January, farmers thought the reason might be increased supply as a result of parents wanting to sell off their stock to get money for back to school. In comparison with cattle and goats, the average prices for sheep are lowest and do not fluctuate as much.

Figure 8. Average price of major livestock species by month (USD)

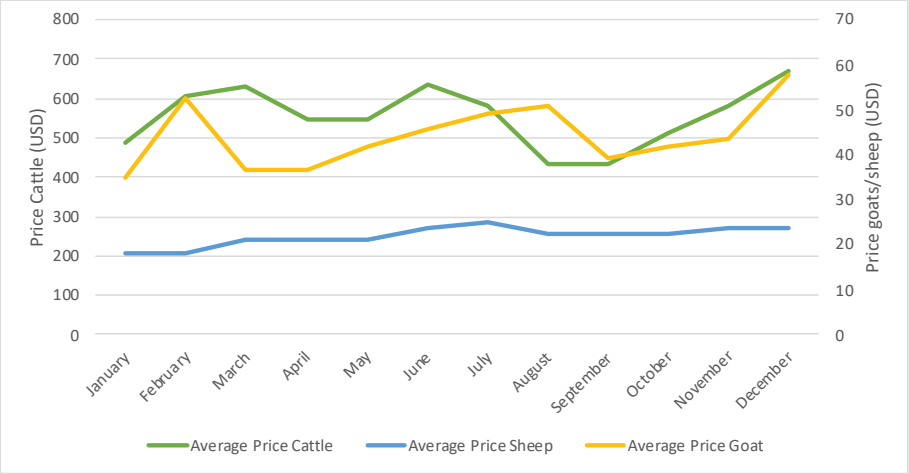


3.9 Daily milk yield

The average daily milk yield decreases from 70 litres per day per household in January to 36 litres per day per household in June. This is attributed to the drop in quantity and quality of forage during the dry season of June, July, August and September.

The average price of a litre of milk does not vary throughout the year and remains at USD0.28 (Figure 9). This is the result of an agreement between a local milk processor, the farmers and the Ministry of Commerce to limit the fluctuation of milk prices with season.

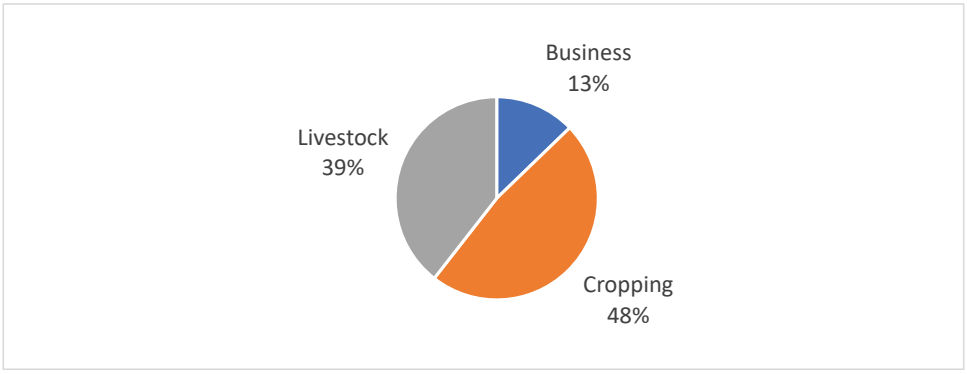
Figure 9. Average daily milk yield (litre) vs. average price received per litre (USD)



3.10 Household income

Agriculture constitutes the main livelihood for farmers in the study area, accounting for close to 87% of household income. Other income generating activities make up for the remaining portion (Figure 10).

Figure 10. Average household income by activity



3.11 Daily labor

The average daily labour rate does not vary between gender and stands at USD1.4.

4 Problems and interventions

Table 3 shows the ranking of problems and interventions by farmers.

Table 3. Major problems and key interventions by importance as ranked by the farmers

No	Problem	Solutions
1	Lack of water	Provision of dam sheets, plastic tanks for rainwater harvesting, construction and installation of boreholes and water supply projects
2	Milk market and marketing issues	Increasing the number of milk customers and increasing milk price
3	Diseases	Good acaricide supply and increasing the number of private veterinarians
4	Feeds	Provision of improved forage varieties with greater yield, disease resistance and drought tolerance, training of farmers in forage production and conservation.
5	Livestock inputs	Subsize livestock inputs

4.1 Lack of water

There is a major problem of water for livestock. Cattle must trek long distances to reach the nearest watering point. The number of constructed valley dams cannot cover the needs of the heads of cattle reared in the study area and district. This can be solved by increasing the number of valley dams to match the present heads of cattle. Importantly, livestock keepers should approach the government and development partners, including projects, to apply for existing subsidy schemes for rainwater harvesting tanks and dam sheets. Developing water supply projects in farms, such as pumping water from Akagera River to the highest elevation point and water supply by gravity only, is also worth considering. This project would benefit both cattle and irrigation for cropland. In addition, the use of underground water by drilling boreholes should also be a solution to the water problem.

4.2 Milk market and marketing issues

Farmers complain that the price of milk is not attractive and think they do not get a fair price for investing their money and time in dairy production. The market is dominated by a single buyer, creating monopoly and stifling competition and permitting the interplay of market forces of demand and supply to lean in their advantage. A value chain analysis will have to be conducted which will, among other things, involve the carrying out of a cost-benefit analysis to determine the real cost of production so as to fix a fair price for milk. Another solution could be facilitating the introduction of other competitors (i.e. other buyers) within the dairy value chain through tax incentives. This can be better handled at a macro level by the government.

4.3 Diseases

In Gacundezi area, tick-borne diseases predominate. Gastro-intestinal parasites, such as worms, also constitute another constraint to dairy farmers of the area. To overcome these challenges, farmers need to be assisted in good practices related to the application of acaricide and an increased coverage of the area by both public and private veterinarians. In addition, the farmers need to be trained on good practices aimed at preventing worms.

4.4 Feeds and feeding issues

Since most farmers use grazing on degraded lands with less digestible forages, this explains the poor nutrition of cattle especially in terms of meeting their protein needs which invariably leads to low milk production and productivity. To solve the feed constraint, improved forage varieties with greater yield and better disease resistance and drought tolerance should be promoted in the area. Furthermore, farmers will have to be targeted with extension messages on the relative merits of growing and feeding their stock with improved forage species, technologies on forage conservation and the need to be market oriented.

4.5 Livestock inputs

Dairy farmers complain of insufficient livestock inputs (chopper machines, mower and baler machines, vet drugs and bovine semen) in the area. In addition, due to insufficient availability of these inputs, the prices are not affordable to many smallholder farmers. To solve this challenge, establishing a subsidy scheme by the government could be an option. Another immediate option for milk collection centres to sign collaborative agreements with wholesalers of livestock inputs to provide inputs to farmers and get payments after the farmers supply milk to the centres. The milk collection centres can also sign an agreement with financial institutions on behalf of dairy farmers for provision of credit facilities. Table 4 shows the FEAST analysis on interventions.

Table 4. FEAST intervention analysis report

Interventions	Mitigate core constraint	Relevance to commodity	Relevance to farm system	Match context attributes	Production impact
Supplementation with energy-rich supplements, e.g. molasses	16	20	20	15	20
Cereal by-products (rice bran, maize, wheat, etc.)	14	20	20	15	20
Supplementation using protein by-products, e.g. from meat, blood and bone, fish, legume leaf meal, biofuel co-products, oil seed, poultry litter, etc.	16	20	20	12	20
Rehabilitation of communal/ degraded grazing lands	15	20	20	12	20
Use of commercial balanced compounded feeds (e.g. dairy meal)	19	20	15	12	20

5 Conclusion and recommendations

The results from ranking of problems clearly indicate water scarcity as the main constraint in the area, especially during the dry season. Milk market and marketing issues is another major problem, followed by diseases, feeds and feeding issues, and insufficient livestock inputs. These could be solved through:

- establishing water harvesting facilities, plastic tanks and dam sheets
- developing water supply projects in farms like pumping water from Akagera River
- improving the use of underground water by drilling boreholes
- encouraging competitiveness in the milk value chain by discouraging monopoly to ensure a competitive pricing
- carrying out of awareness campaigns and training farmers in good practices related to the application of acaricide and increasing of public and private veterinarians
- providing farmers with improved forage varieties which are greater yielding, disease and drought tolerant, and training farmers on pasture improvement and forage conservation
- Supplementing rations with energy and protein rich supplements

References

Duncan, A., York, L., Lukuyu, B., Samaddar, A. and Stűr, W. 2012. *Feed Assessment Tool (FEAST)*. www.ilri.org/feast.

ILRI. 2015a. Feed Assessment Tool (FEAST) focus group discussion guide. Nairobi, Kenya: ILRI. www.ilri.org/feast.

ILRI. 2015b. Feed Assessment Tool (FEAST) individual farmer interview questionnaire. Nairobi, Kenya: ILRI

NISR. 2012. Fourth Population and Housing Census, Rwanda, 2012. Census Atlas.

NISR. 2017. Agriculture Household Survey. Report, December 2018.

Annnex

Details on suitability of each intervention derived from FEAST intervention ranking analysis

Supplementation with energy-rich supplements, e.g. molasses

Score	Value	Rationale
Mitigate core constraint	16	Overall, the scores suggest that this intervention has a high potential to mitigate the area's core constraints. • High potential to mitigate the area's dry season feed scarcity issues, which the survey rated as a major constraint • High potential to mitigate the area's growing season feed scarcity issues, which the survey rated as a minor constraint • Low potential to mitigate the area's feed quality issues, which the survey rated as a major constraint • Very high potential to mitigate the area's feed quantity issues, which the survey rated as a major constraint
Relevance to commodity	20	This intervention is considered very highly suitable for communities reliant on dairy cattle.
Relevance to farm system	20	This intervention is considered very highly suitable for communities where the farming system is largely intensive mixed crop-livestock system (including trees).
Match context attributes	15	This intervention is considered: • Generally reasonable for communities with medium land availability. • Possible (but not ideal) for communities with low water availability. • Possible (but not ideal) for communities with medium labour availability. • Possible (but not ideal) for communities with high cash/credit availability. • Possible (but not ideal) for communities with high input delivery availability. • Too resource-intensive for communities with low knowledge/skill availability.
Production impact	20	Where suitable, this intervention is expected to have a very high impact.

Cereal byproducts (rice bran, maize, wheat, etc.)

Cereal brans are obtained during milling and processing of grains. Commonly available brans are rice, wheat, barley, maize, sorghum and pearl millet. They are highly valued for their nutrient content and are widely used as a feed supplement for monogastric (e.g. pigs) and ruminant (e.g. cattle) animals. Cereal by-products are traded extensively and there is high demand locally and internationally. They are commonly fed along with other supplements like oil cake, grain and pulse husk, or in compound feeds.

Score	Value	Rationale
Mitigate core constraint	14	Overall, the scores suggest that this intervention has a moderate potential to mitigate the area's core constraints. • High potential to mitigate the area's dry season feed scarcity issues, which the survey rated as a major constraint • Moderate potential to mitigate the area's growing season feed scarcity issues, which the survey rated as a minor constraint • Low potential to mitigate the area's feed quality issues, which the survey rated as a major constraint • High potential to mitigate the area's feed quantity issues, which the survey rated as a major constraint
Relevance to commodity	20	This intervention is considered very highly suitable for communities reliant on dairy cattle/buffalo.
Relevance to farm system	20	This intervention is considered very highly suitable for communities where the farming system is largely intensive mixed crop-livestock system (including trees).
Match context attributes	15	This intervention is considered: • Generally reasonable for communities with medium land availability. • Possible (but not ideal) for communities with low water availability. • Possible (but not ideal) for communities with medium labour availability. • Possible (but not ideal) for communities with high cash/credit availability. • Possible (but not ideal) for communities with high input delivery availability. • Too resource-intensive for communities with low knowledge/skill availability.
Production impact	20	Where suitable, this intervention is expected to have a very high impact.

Supplementation using protein by-products, e.g. meat, blood and bone, fish, legume leaf meal, biofuel co-products, oil seed, poultry litter, etc.

Score	Value	Rationale
Mitigate core constraint	16	Overall, the scores suggest that this intervention has a high potential to mitigate the area's core constraints. • High potential to mitigate the area's dry season feed scarcity issues, which the survey rated as a major constraint • High potential to mitigate the area's growing season feed scarcity issues, which the survey rated as a minor constraint • Low potential to mitigate the area's feed quality issues, which the survey rated as a major constraint • Very high potential to mitigate the area's feed quantity issues, which the survey rated as a major constraint
Relevance to commodity	20	This intervention is considered very highly suitable for communities reliant on dairy cattle/buffalo.
Relevance to farm system	20	This intervention is considered very highly suitable for communities where the farming system is largely intensive mixed crop-livestock system (including trees).
Match context attributes	12	This intervention is considered: • Generally reasonable for communities with medium land availability. • Possible (but not ideal) for communities with low water availability. • Possible (but not ideal) for communities with medium labour availability. • Too resource-intensive for communities with high cash/credit availability. • Too resource-intensive for communities with high input delivery availability. • Too resource-intensive for communities with low knowledge/skill availability.
Production impact	20	Where suitable, this intervention is expected to have a very high impact.

Rehabilitation of communal/degraded grazing land

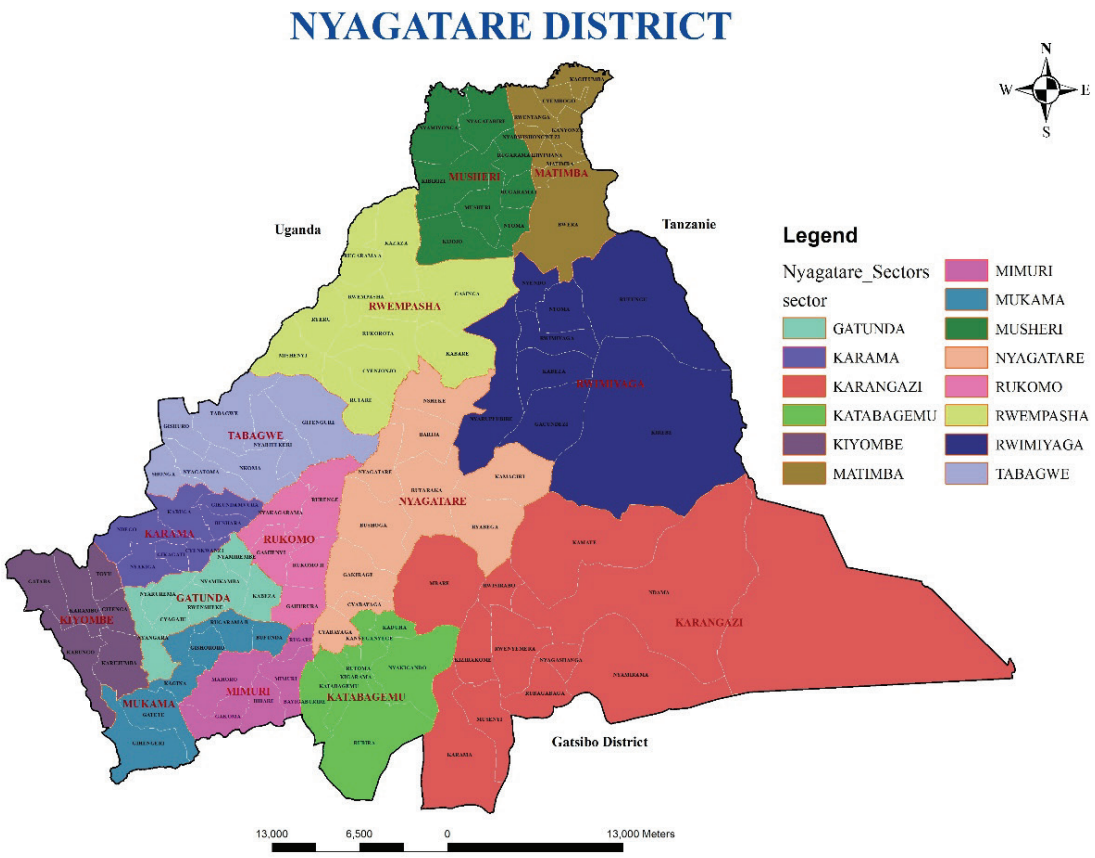
Score	Value	Rationale
Mitigate core constraint	15	Overall, the scores suggest that this intervention has a high potential to mitigate the area's core constraints. • Moderate potential to mitigate the area's dry season feed scarcity issues, which the survey rated as a major constraint • Moderate potential to mitigate the area's growing season feed scarcity issues, which the survey rated as a minor constraint • High potential to mitigate the area's feed quality issues, which the survey rated as a major constraint • High potential to mitigate the area's feed quantity issues, which the survey rated as a major constraint
Relevance to commodity	20	This intervention is considered very highly suitable for communities reliant on dairy cattle/buffalo.
Relevance to farm system	20	This intervention is considered very highly suitable for communities where the farming system is largely intensive mixed crop-livestock system (including trees).
Match context attributes	12	This intervention is considered: • Possible (but not ideal) for communities with medium land availability. • Possible (but not ideal) for communities with low water availability. • Possible (but not ideal) for communities with medium labour availability. • Possible (but not ideal) for communities with high cash/credit availability. • Possible (but not ideal) for communities with high input delivery availability. • Too resource-intensive for communities with low knowledge/skill availability.
Production impact	**20**	Where suitable, this intervention is expected to have a very high impact.

Use of commercial balanced compounded feeds (e.g. dairy meal)

Balanced concentrates are nutrient-dense supplements to low-quality basal feeds. They are a mixture of high-quality feed ingredients such as cereal by-products, oilcakes, grains, roots/tubers, molasses, minerals and vitamins. Many concentrate mixes contain urea as a non-protein nitrogen source to partially replace more expensive oil cake protein sources. The amount of concentrate added to the basal diet depends on the quality of the basal diet and the nutritional needs of the animals. For example, high level of concentrate supplementation is needed for high milk yields. Balance concentrates can be purchased or, if suitable ingredients are available, can be made by farmers. Balance concentrates are usually in the form of powder/mash or pellets.

Score	Value	Rationale
Mitigate core constraint	19	Overall, the scores suggest that this intervention has a high potential to mitigate the area's core constraints. • Very high potential to mitigate the area's dry season feed scarcity issues, which the survey rated as a major constraint • Moderate potential to mitigate the area's growing season feed scarcity issues, which the survey rated as a minor constraint • Moderate potential to mitigate the area's feed quality issues, which the survey rated as a major constraint • Very high potential to mitigate the area's feed quantity issues, which the survey rated as a major constraint
Relevance to commodity	20	This intervention is considered very highly suitable for communities reliant on dairy cattle/buffalo.
Relevance to farm system	15	This intervention is considered highly suitable for communities where the farming system is largely intensive mixed crop-livestock system (including trees).
Match context attributes	12	This intervention is considered: • Generally reasonable for communities with medium land availability. • Possible (but not ideal) for communities with low water availability. • Possible (but not ideal) for communities with medium labour availability. • Too resource-intensive for communities with high cash/credit availability. • Too resource-intensive for communities with high input delivery availability. • Too resource-intensive for communities with low knowledge/skill availability.
Production impact	20	Where suitable, this intervention is expected to have a very high impact.

Map of Nyagatare district



The International Livestock Research Institute (ILRI) works to improve food and nutritional security and reduce poverty in developing countries through research for efficient, safe and sustainable use of livestock. Co-hosted by Kenya and Ethiopia, it has regional or country offices and projects in East, South and Southeast Asia as well as Central, East, Southern and West Africa. ilri.org

CGIAR is a global agricultural research partnership for a food-secure future. Its research is carried out by 15 research centres in collaboration with hundreds of partner organizations. cgiar.org