Characterization of livestock production systems and the potential of feed-based interventions to improve livestock productivity in Luanda sub county of Vihiga County, Kenya

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The Feed the Future Kenya Accelerated Value Chain Development (AVCD) program seeks to widely apply technologies and innovations for livestock, dairy and staple crop (root crops and drought-tolerant crops) value chains in order to competitively and sustainably increase productivity, contributing to inclusive agricultural growth, nutrition and food security in 23 counties in the country. Supported by the United States Agency for International Development as part of the US government's Feed the Future initiative, its main goals is to sustainably reduce poverty and hunger in the Feed the Future zones of influence in Kenya.

In partnership with the International Crops for Research Institute for Semi-Arid Arid Tropics (ICRISAT) and the International Potato Center (CIP), International Livestock Research Institute (ILRI) will lead the implementation of AVCD. The three CGIAR centres will work closely with partners—county governments, NGOs, CBOs, private sector actors and other USAID-funded projects/programs, as well as leverage knowledge and best practices from academic institutions and foundations.

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Executive summary

The farming system in Luanda sub-county is typically intensive mixed crop livestock system and most of the households (60%) own less than one hectareof land. The average size of a household is 6 persons. Rainfall pattern in the area is bi-modal; with long rains occurring between March and July with peak rains in April and May, and the short rains between September and November. January is generally dry. The main water sources include rivers, protected springs, boreholes, permanent wells, and roof catchments. The average distance for the people to access water is approximately 1 km.

Major income sources in the area include livestock (milk and livestock sales) which contributes to 57% of the total income and crops (mainly maize, beans and bananas) contributing to 23%. Most of the crops grown are mainly for subsistence. Livestock holdings include improved dairy cattle (Friesian, Ayrshire, Guernsey and Jersey), local Zebu cattle, goats, sheep and poultry (mainly local chicken).

Most of the improved dairy cattle are kept under zero grazing units and supplemented with concentrates (20% of the farmers), while local Zebus are tethered along the roads and near homesteads. Cultivated fodder and purchased feed is the base feed source, with Napier being the dominant fodder in either case. Crop residue is also an important feed source during crop harvesting and fed with minimal treatment (chopping).

Labour is available throughout the year, although affordable to only 30% of the farmers and there is no gender difference in wages paid to women and men. The cost of labour varies little throughout the year and there is a higher labour demand during land preparation, planting, weeding and harvesting.

Livestock prices vary with seasons, with highest prices observed during the festive seasons (April, August and December) and the lowest in January and February. The average distance from the market is about 4 km.

Informal credit sources such as 'Merry go round' and table banking form the main source of credit for the farmers (80%). Formal credit sources are available but not commonly used due to strict regulations.

Major challenges experienced by farmers in the dairy sub sector include low quality semen, few inseminators, low quality of breeding stock, tick borne diseases, feed shortage and infertility.

Introduction

Feed is one of the required inputs to enhance smallholder livestock systems that operate under diverse socio-economic and environmental contexts. Improving the availability and use of diverse feeds requires a formal gap assessment that is often done using conventional feed quantity and quality analytical procedures. The disadvantage of such an approach is that the assessment is made in isolation from the overall livelihood context of smallholder farmers. FEAST (Feed Assessment Tool) is designed to overcome such aspects while assessing feed situations under typical smallholder farming situations.

Methodology

Study area

Luanda Sub County is one of the five sub counties in Vihiga County. It is located 32 km from Kisumu (along Kisumu-Busia road) and about 14 km from Majengo. It borders Emuhaya to the North, Vihiga to the East, Kisumu to the West and Siaya to the South, covering an area of 85 km^2. The population size is 107,012 people (projection for 2015) translating into a population density of about 1,200 persons per km^2. It has five (5) wards; Luanda Township, Luanda South, Mwibona, Emabungo and Wemilabi, with approximateley 21,400 households in total. The soil type ranges from loam to sandy loam. The sub county lies between two climatic zones (LM2 and LM3). The dairy project under ILRI covers the entire sub county.

The area receives about 1800-2100 mm of rainfall per annum in a bimodal pattern. Rainfall is adequate to grow fodder throughout the year, although feed shortage is experienced, due to small land size and inadequate knowledge on fodder conservation and proper utilization of crop by-products. The inhabitants in the area are mixed farmers; keeping livestock and growing crops. The main livestock enterprises in the use improved and local dairy cattle, local chicken, and goats and sheep. The ruminants are kept for milk, meat, manure and for paying dowry.

The Feed Assessment Tool (FEAST) was used to assess the livestock production system and local feed resources in Luanda Sub-County, Vihiga County, Republic of Kenya, in cooperation with Luanda community dairy farmers.

A technical team was established and briefed about FEAST and the planned exercise. Five wards were selected, and four farmers were randomly selected from each ward. A total of 20 farmers were selected and invited to attend the focus group discussion at Ebusiralo Church of God which was easily accessible to the participants. From the 20 farmers identified, 16 attended and participated in the FEAST focus group discussion (FGD) exercise on 26th May 2016. Nine of the respondents were males and seven females.

Through the discussions, farmers were grouped into 3 categories based on their Wards of origin. Category 1 (Luanda South Ward), category 2 (Luanda Township and Mwibona Ward) and category 3 (Emabungo and Wemilabi Wards). Each group was requested to nominate one member that represents each of the three land categories, small, medium and large-land size categories as defined by the FGD. Nine farmers (three females) were retained for further individual interview using separate questionnaires.

Data was collected thorugh the individual interviews and focus group questionnaires, and then analyzed using the FEAST application. Potential interventions were also derived from the group discussion and the FEAST analysis.

Results and discussion

Farming system

The average household size in Luanda Sub County is 5 members, with an average farm size of 0.6 hecatres. Table 1 below shows the average land sizes for different categories as to the farmers' perception. The majority of farmers (60%) owned less than one hectareof farmland and 30% owned 1-2 hectares.

Table 1: Average land sizes owned by different categories of farmers in Luanda Sub County.

Category of farmer	Range of land size (hectares)	% of households
Landless	0	1
Small scale farmers	<1	60
Medium	1-2	30
Large scale farmers	>2	9

Major income sources

Livesock production is the most important source of income for the farmers in the Sub-County. The main livestock enterprises include; dairy farming, poultry and goat farming. Poultry production (village condition) also forms an important source of income both for meat and egg, together with dairy goats and local cattle. Pigs are kept by a few farmers in the area. The main contributors to household income are milk/livestock sales (57%), sale of crops mainly maize, beans & bananas (23%) and off farm business (16%). Remittance and labour contributed to 2% (Figure 1).
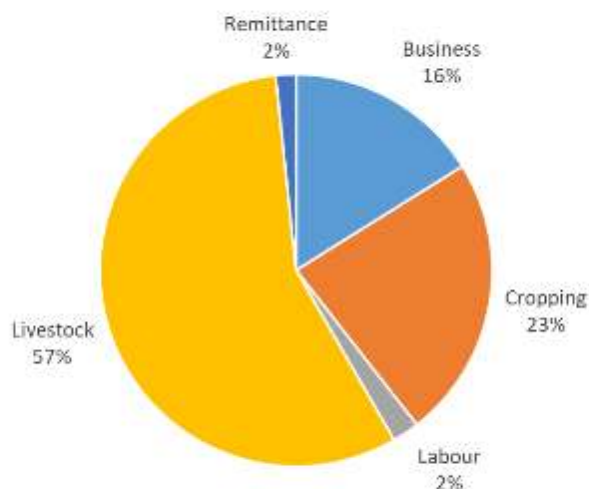
Figure 1: Contribution of livelihood activities to household income (%).

Availability of labour

The small land sizes together with the large population in the area make labour easily available, although only 30% of the farmers can afford it. The availability of labour also varies with seasons, with high demand experienced during land preparation, planting, weeding and harvesting. The cost of labour per person/day ranges between KES 200 to KES 300 ($2 to $3). There is no gender difference in wages paid to women and men. The labourers are provided with breakfast and lunch. Some farmers hire labour for livestock (dairy) farming activities and paid on a monthly basis.

Crop production and seasons

The production system consists of an intensive mixed crop- livestock system, including trees. Both cash and food crops are grown. The most common crops grown are; maize (planted with beans), bananas, soya beans and sweet potatoes. Maize and beans are grown in two seasons/year and are mainly for household consumption. Soya bean, sweet potatoes and vegetables are grown during the short rains. Figure 2 below shows some of of the crops grown in Luanda Sub- County.
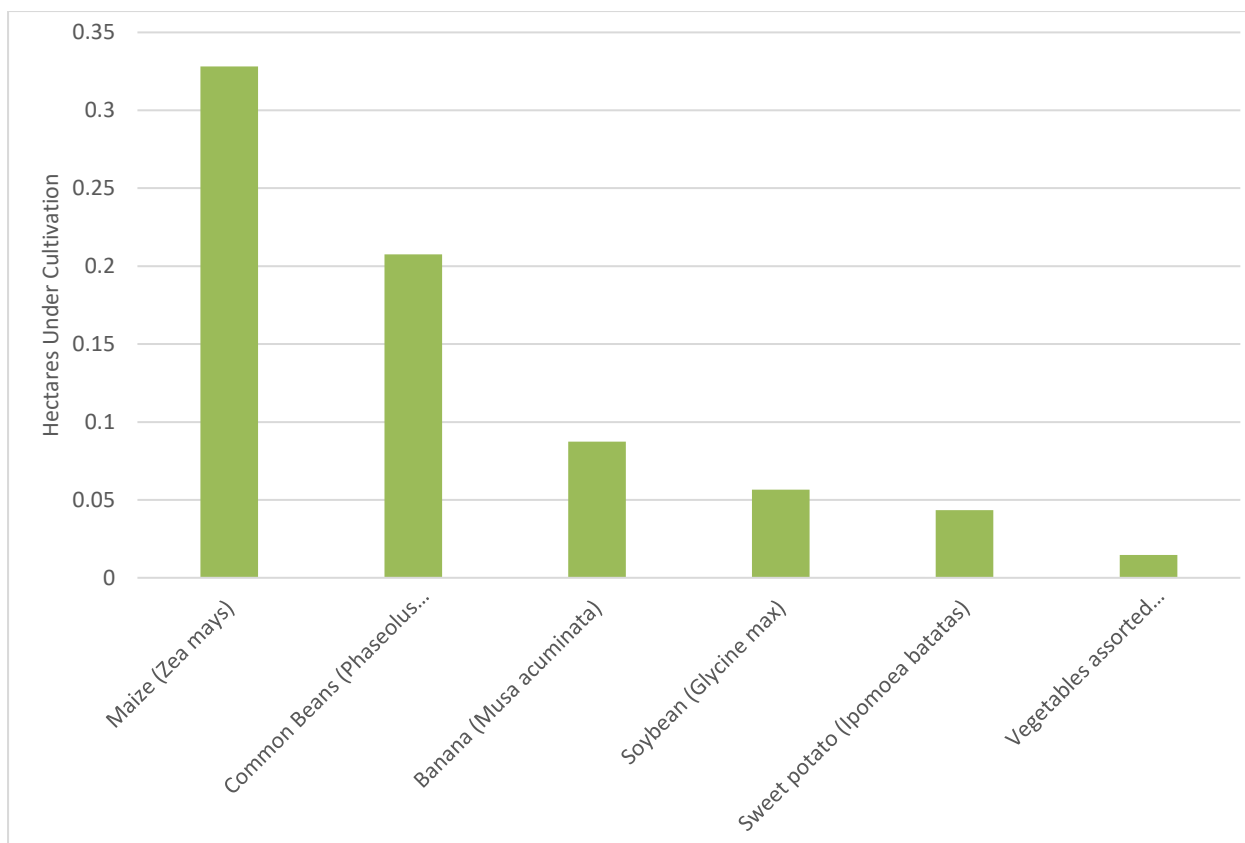
Figure 2: Crops grown in Luanda sub-

Farmers in Luanda sub county expereince two wet seaons and dry seasons. The main long rainy season (*Erotso*) is from March-July. The short rains (*Esubwe*) are observed in September-November. December-February are dry months with an additional short dry spell occuring in August. Table 2 below shows the rainfall seasons that set the cropping seasons (as described by the farmers).

Table 2: Rainfall seasons and corresponding cropping seasons in Luanda

Name of season	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Long Rain(Erotso)												
Short Rain (Esubwe)												
Dry Season (Esimulu)												

Livestock production systems

Cattle are the most important livestock species in the livestock system (Figures 3 and 4), providing milk and cash income to the household. Zebu, a local indigenous breed is the most important breed and kept by approximately 55% of the households. However, the level of improved breeds and upgrading of local breeds through artificial insemination is on the rise, as there is an effort to improve milk production per cow, due to increasing demand for milk. The dairy breeds reared include Friesian, Ayrshire, Guernsey and Jersey and their crossbreeds.
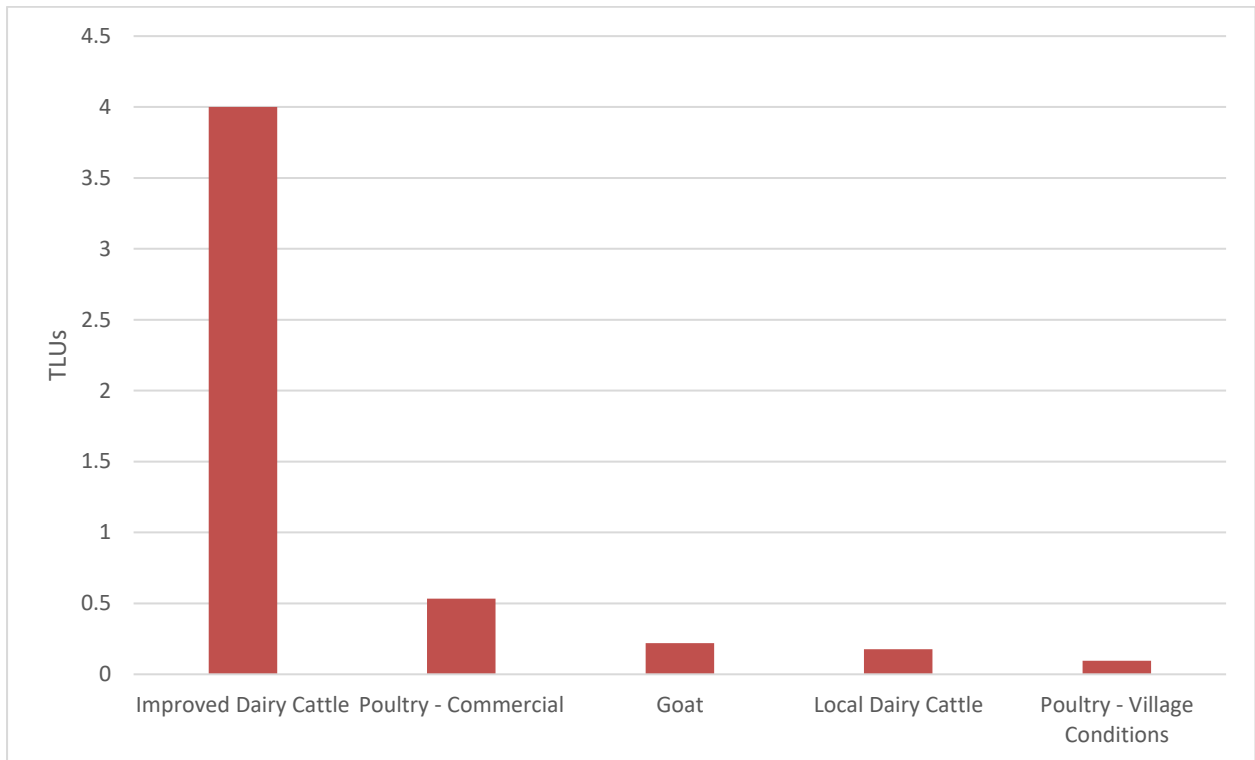
Figure 3: Dominant livestock species kept by households by average in Luanda sub county (TLU/household).
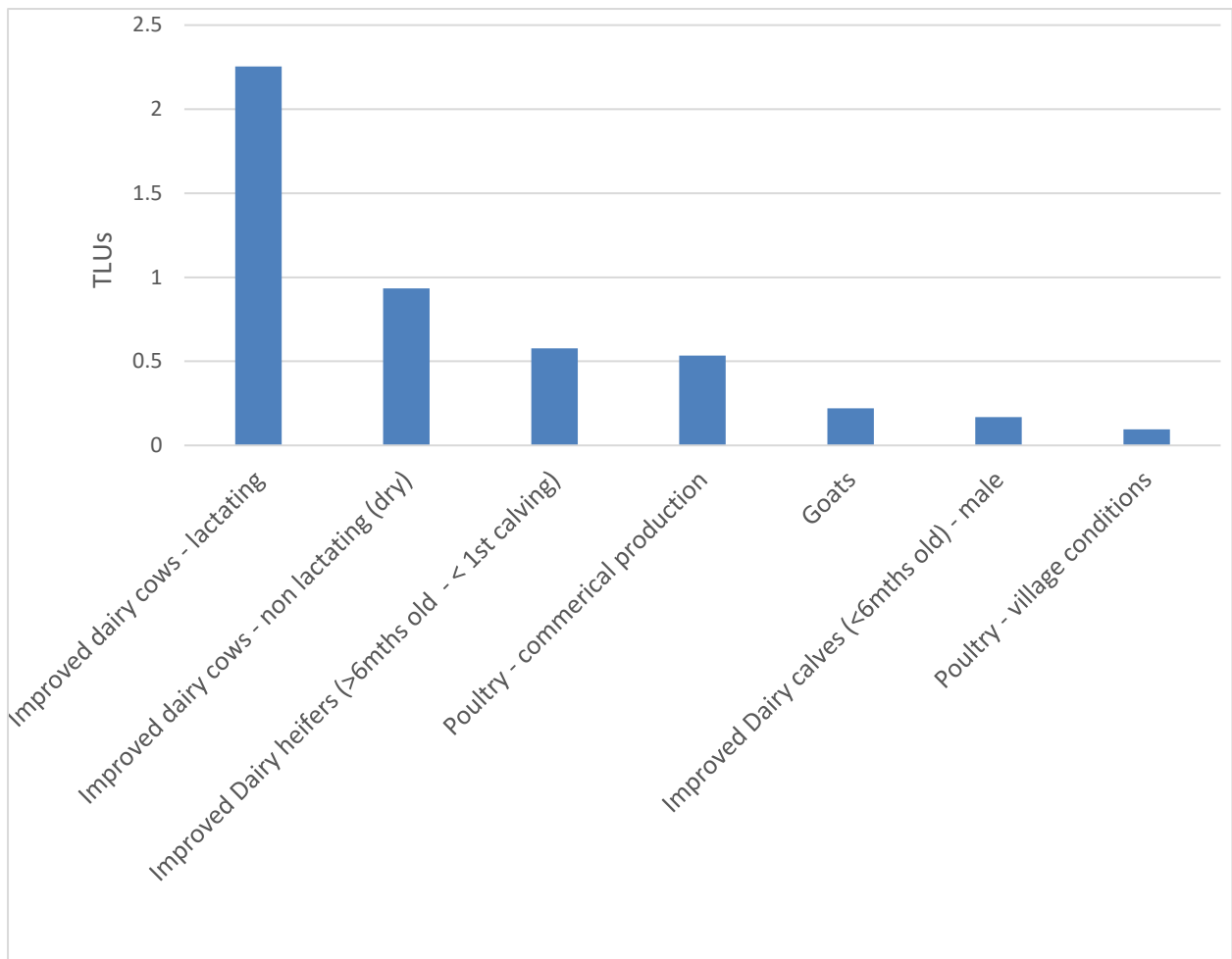
Figure 4: Average livestock holdings per household by type in Tropical Livestock Units (TLU's)

Approximately 20% of the farmers keep improved cattle with two animals per household. All cows are milked regularly during lactation. The average milk production per cow/day is 8 litres for the improved breeds and 1.5 litres for the local breeds. The collected milk is mainly sold at the farm gate due to high demand, and the remaining sold individually at the market centres, shops, hotels or collected to the Bunyore Livestock Cooperative Society. The average milk price per litre ranges between KES 60 to KES 75 (USD $ 0.6 to USD $ 0.75) per litre throughout the year.

Livestock management and services

Livestock management practices are generally comparable between households in the area. However, they tend to differ significantly based on the breeds (exotic vs local Zebu). The local Zebu breeds are often grazed along the roads or tethered within the compound or fallow lands with minimal supplementation of Napier, crop residue or natural grassland. They are confined in the cattle night sheds overnight. Improved cows and cross breeds are mainly kept under zero grazing unit and stall fed on green pasture, fodder and crop residues. They are also supplemented with mineral licks and feed concentrates. Poultry production is predominantly indigenous chicken kept under free range with minimal supplementation, and housed within the residential houses during

the night. The birds are restrained in temporary structures during the planting season to minimize damage to the crops. Goats are of local breed type and tethered within the close proximity of the home. Some households keep their dairy goats in pens and provide them with feedstuff and water.

Private and government veterinarians provide animal health services to farmers while livestock officers provide extension services. However, the services by the government veterinarians are limited due to the few personnel, while the private services remain costly to most farmers. The veterinary department often vaccinates cattle against Anthrax and black quarter.

Private artificial insemination(AI) services are available to farmers within Luanda Sub County. The services, however, are mainly concentrated around Luanda town. AI charges are variable, depending on the practioner and distance, and ranges between KES 1,000 to KES 1,500 (USD $10 to USD $ 15). About 70% of the local farmers still use bull services for breeding despite their challenges. The bull services costs between KES 500 to KES 700 (USD $ 5 to USD $ 7) for the exotic bulls.

Livestock market prices
Cattle prices, especially for local Zebu, vary with season and increase during the festive season November- December, costing around KES 20,000 (USD $200) per head. The price drops drastically in January - February to KES 12,000 - KES 15,000 (USD $120 to USD $ 150) per head. The drop is associated with the opening of schools, where farmers are forced to sell their stock to pay school fees, causing an over-supply in the market. The prices for sheep and goats (shoats) equally varies with seasons, with high demands noticed during Easter in April and Christmas in December. The price at these peak periods is between KES 4,000 to KES 5,000 (USD $40 to USD $ 50) per head. The prices are relatively stable during other times of the year.

Major feed sources throughout the year
Four feed categories contrbuted to the total diet dry matter (DM) in Launda sub county (Figure 5). Cultivated fodder and purchased feeds each contrbuted to 39% and 38%, respectively. Napier grass is the most important cultivated fodder grown in the area. Grazing is insignificant within the area throughout the year, contriburing to less than 2% to overall diet due. This is probably due to the small land sizes which then requires stall feeding and a cut and carry system.
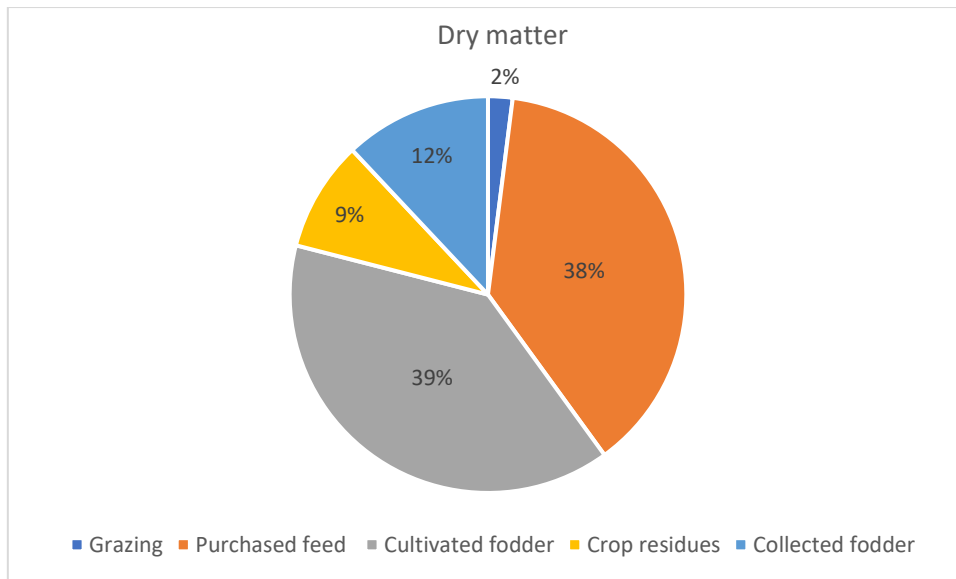
Figure 5: Contrbution of feeds to livestock total diet dry matter (DM) in Launda sub county

A similar trend is observed when contrbutions are calculated on metabolizable energy (ME) (Figure 6). Cultivated fodder contrbuted to the highest ME (40%), followed by purchased feeds. Figure 7 shows the contrbutions of cruide protein (CP), as expected, cultivated fodder contributed to about 44% of the total diet CP. Grazing and crop residues contributed the least CP.

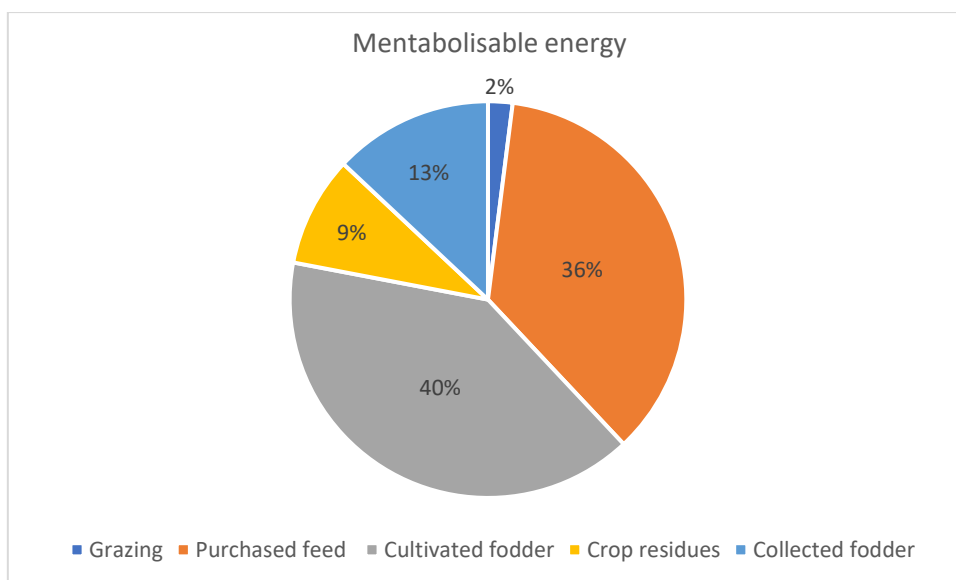
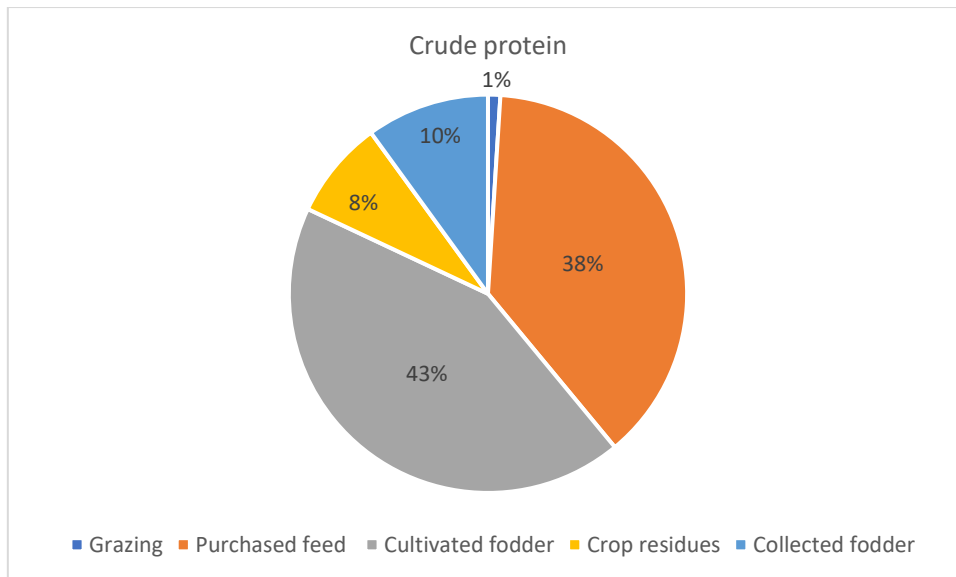Figure 6: Contrbution of feeds to livestock total metabolizable energy (ME) in Launda sub county

Figure 7: Contrbution of feeds to livestock total crude protein (CP) in Luanda sub county

Green forage, mainly Napier grass, is the primarily cultivated fodder crop widley used by farmers (Figure 8). Napier grass is cultivated on land not exceeding 0.3 ha/household. Other cultivated fodder types include Desmodium, Rhodes grass and Calliandra.

The most common feed bought by farmers are green fodders (Napier, Bermuda, and Kikuyu grasess), concentrate feeds and maize stover. On average, households buy less than 10,000 kg/year Napier grass (Figure 9).
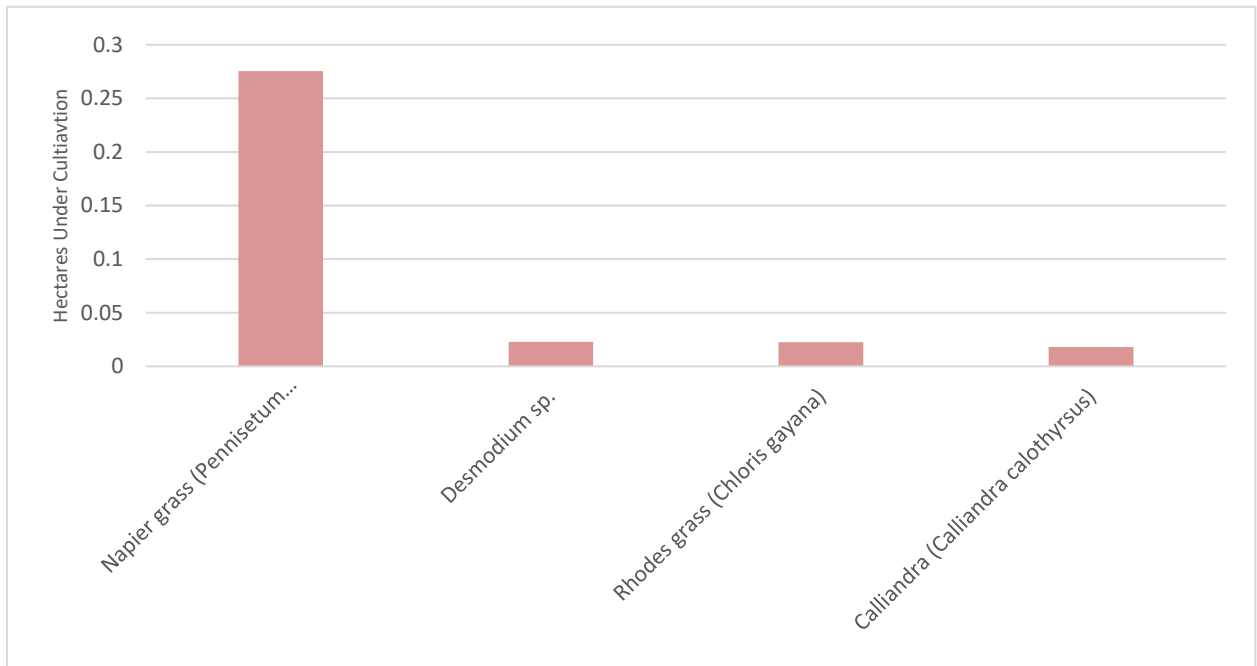
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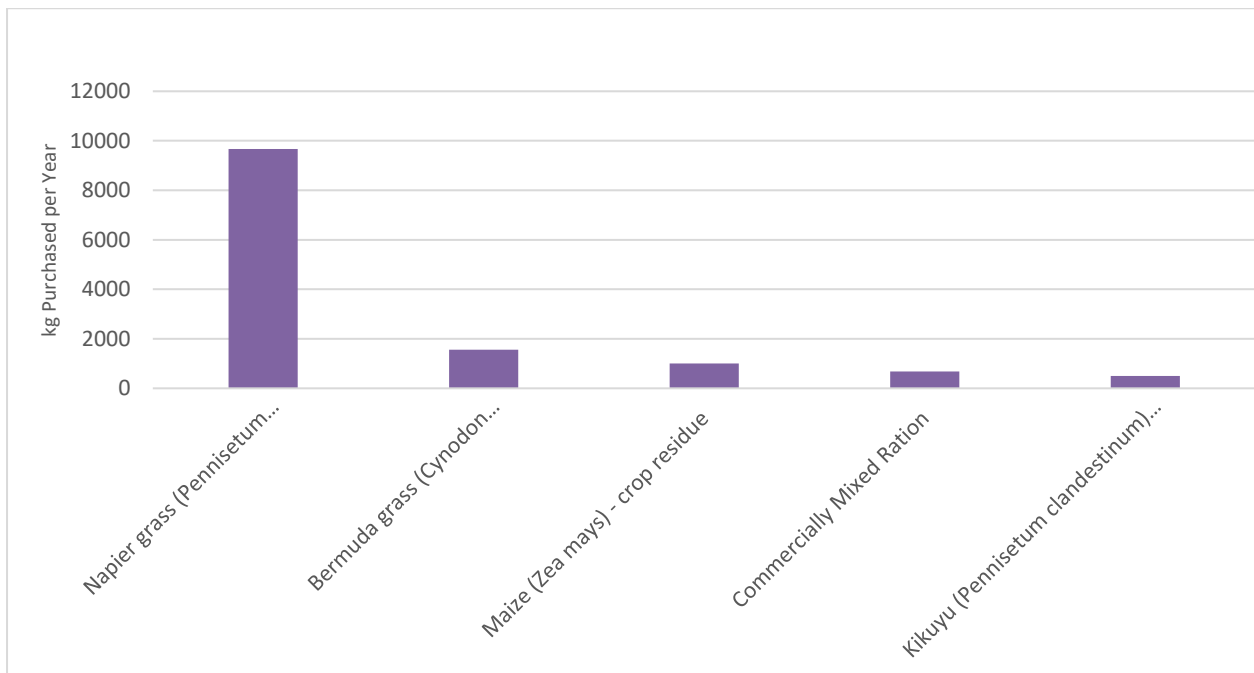Figure 8: Dominant fodder crops cultivated in Launda sub county (ha/household)

Figure 9: Dominant purchased feed types by kg

Feed and rainfall availability

Feed availability is above average between April and August (Figure 10). Green forages are available during April and August, reaching a peak in May and June due to the onset of the long rains. Crop residue, mainly maize stovers and leguminous-beans hulls, form an important source of feed during the months of July to September and December to January (harvesting seasons). About 20% of the farmers feed their livestock on concentrate feeds. Concentrate feeding is important throughout the year due to low quality feedstuff such as crop residue and poorly managed Napier. Feed availability fluctuates widely throughout the year as farmers have not adopted feed conservation strategies.
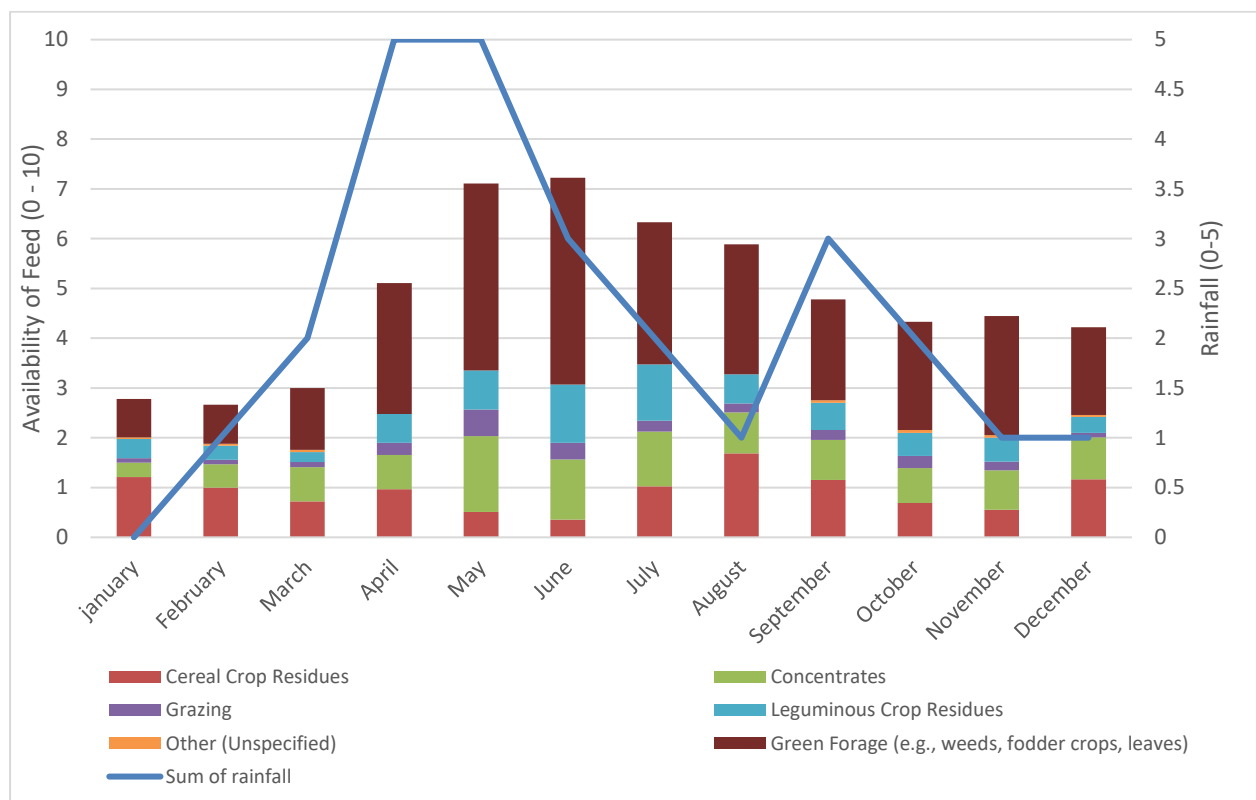

Figure 10: Rainfall availability and corresponding annual fodder availability

Key challenges and suggested interventions

The main challenges faced by the farmers are low quality of semen, few inseminators, low quality of breeding stock, tick-borne diseases, feed shortage characterized by poor quality and quantity and infertility (Table 3). Suggested interventions include informing and educating farmers and service providers on the use of improved technologies such as AI. Farmers want to use sexed semen in order to increase their chances of getting female dairy calves.

Most of the farmers purchase their breeding stock from the market without proper records of cow performance. This often leads to poor cow performances, as some of the breeding stocks are inbred and/or bulls of unknown records. Backcrossing of improved cows with local bulls has also led to inferior breeds.

Feed is ranked as the fourth key challenge. The system relies heavily on cultivated fodder which is dominated by Napier grass. Napier grass quality is highly dependent on rainfall availability and proper management together with the type of planting materials. The prevalence of Napier stunt disease has highly aggravated the feed shortage in the area and causing a drastic reduction in biomass production. Due to the small land sizes, most farmers harvest their Napier prematurely, and with minimal management (low fertilization) leading to low quality and quantity of feed. Some farmers are switching to the production of Mulato II grass, Desmodium, Calliandra and Boma Rhodes to mitigate against the Napier grass production challenges. However, there is little attempt to improve the quality of crop residues in the area. Chopping of the feedstuff using pangas is the main feed processing technique. The feed problem is also aggravated by farmers forced to harvest their Napier prematurely, and with minimal management (low fertilization) leading to low quality and quantity of feed.

Low conception rate is a common phenomenon in the area caused by a range of factors such as poor nutrition, poor heat detection, and herd health among other factors. Feeding, however, is the leading factor for infertility in the area. Other farmers complain of silent heat signs due to low supervision of the animal.

Table 3: Livestock production challenges and potential interventions

Rank	Challenges	Suggested farmer interventions
1	Low quality semen and few inseminators	• Subsidizing sexed semen • Training of additional inseminators
2	Low quality of breeding stock	• Improved adoption of AI technology. • Training/ sensitization on AI
3	Tick- borne diseases	• Regular spraying • Vaccination • Training on disease control • Demonstrations on proper spraying
4	Feed shortage (poor quality and low quantity)	• Training on Feed conservation& utilization • Bulking of quality planting materials • Training on feed formulation
5	Infertility	• Training on breeding • Training on record keeping • Training on proper feeding

To alleviate feed constraints, there is a need to use improved technologies such as crop residue treatment (Urea treatment), use of hydroponics to establish fodder and diversification of fodder and pastures. It is necessary to bulk improved varieties of Napier such as Ouma II and South Africa. Proper conservation techniques can also be explored to reduce fluctuation in feed availability. Intercropping of Napier with legumes such as Desmodium can also improve nutrition. The farmers should consider buying bulks of feed concentrates to benefit from economies of scale, which can significantly reduce the costs.

To improve the quality of breeding stock, it is important to upgrade existing cattle using AI and keep proper records. In order to improve on fertility, the farmers should be educated on nutrition, heat detection, heat stress and general fertility management.

Demonstration on proper mixing of acaricides and effective spraying is crucial to avoid tick menace. Furtermore, educating farmers on the importance of ECF vaccinations can be a way of controlling the diseases.

Conclusions

The residents of Launda sub county depend on intensive mixed crop and livestock systems with farmland sizes under one hectare/household. Over half of the household income is derived from milk sales. Crop cultivation is limited and consists of inter-cropping with other legumes. The largest contribution of livestock feed is green cultivated fodder, especially Napier grass. As the livelihoods of farmers depend on dairy production, the availability of quality semen and inseminators are the most limiting factors in the sub county. The high cost of insemination is one of the key challenges to produce replacement stock. Additionally, tick-borne diseases, due to improper spraying, has caused great losses to some farmers. The prevalence of Napier stunt disease has highly aggravated feed shortage in the area by causing a drastic reduction in biomass production.

Annexes

1. Attribute content scores

S/No	Context Attribute	Score (0-4)	Reference
1	Availability of cash	2	Question 1.8 FEAST discussion guide
2	Availability of input delivery	3	Question 1.10 FEAST discussion guide
3	Availability of knowledge	2	Own judgement
4	Availability of labour	3	Question 1.6 FEAST discussion guide
5	Availability of land for fodder conservation.	1	Question 1.9 FEAST discussion guide
6	Availability of water in the growing season	3	Question 1.5.2 FEAST discussion guide