Characterization of livestock production systems and the potential of feed-based interventions to improve livestock productivity in Gem sub-county, Siaya 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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Introduction

Gem is a sub-County located within Siaya County, Kenya, with a total land area of 40,500 hectares, of which 34,300 hectares are arable land and less than 30 hectares under irrigation. The sub-County receives an annual rainfall ranging from 800mm (minimum) to 1600mm (maximum). The sub-County has a total population of about 155,000 people whose main economic activity is agriculture.

Gem has the highest potential for dairy production in Siaya County due to its favourable climate and existing dairy infrastructure. There are two milk processing plants in Yala township ward and nine milk collection centres: Yala township, Nyagondo, Ramula, Apuoyo, Bama, Bagdad, Yaw pachi, Kodiaga and Nyawara. The milk from these collection centres then goes to the main dairy, New Yala Dairy. The dairy collects about 400 liters of milk/day from farmers, which is below the amount produced within the sub-County daily, due to management issues. Gem sub-County produces about 7.2 million litres of milk annually from both improved and indigenous dairy herds. It also has the highest number of grade dairy cows within the county, with a total of 3200 - about 45% of the county grade dairy herd.

The Feed Assessment Tool (FEAST), developed by researchers at the International Livestock Research Institute (ILRI), was used to characterize the feed-related aspects of the livestock production system in Yala Dairy catchment area and to provide suggested feeding system interventions.

Study objectives

- To get a general overview of the agricultural systems within the catchment.
- To identify major challenges faced by farmers in the sub-County as well as possible mitigation strategies.
- To identify major feeds and feeding related problems, existing opportunities and potential interventions that improve feed supply and utilization all year round.

This would enable the county government to plan for mitigation measures in their respective ward development budgets.

Methodology

The exercise was part of the Accelerated Value Chain Development-Dairy Value Chain project, and was carried out in June 2016 by the County government of Siaya Directorate of Livestock Production, in collaboration with ILRI. The assessment was carried out through a farmer-centred-diagnosis research methodology, which involved holding focus group discussions (FGD) and one-on-one interviews with farmers to get their input on the local farming system, feed-related problems and potential interventions. For this, the Feed Assessment Tool (FEAST), was used (www.ilri.org/feast).

Sampling

A focus group discussion was carried out with 22 farmers (8 female and 14 male) to get an overview of the farming systems of the sub-County. Nine farmers were selected from the group discussions to represent the three landholding categories: small, medium and large scale as determined by the FGD participants. Three farmers from each category were individually interviewed to collect information on feed resources and feeding practices.

Data collection

The assessment, carried out in Wagai Assistant County commissioner's office compound, was done using both qualitative and quantitative methods of data collection. The FGDs were used to gather quantitative and qualitative data about general farming systems in the area including farm sizes, household sizes, farm labour, annual rainfall pattern, irrigation, animal species, animal health and reproduction, availability of credit services, availability of farm inputs, problems, challenges and opportunities within the livestock system. Individual interviews were carried out using structured questionnaires that were administered to the nine farmers. Individual interviews questioned issues on breed type, food and cash crops grown, fodder grown on farms, utilization of crop residues, sources of animal feeds and income sources at farm level. Data from FGDs and individual interviews was fed into the FEAST application for analysis.

Data analysis

The qualitative information gathered during the focus group discussion and interviews was analyzed and reported. The quantitative data collected were entered into the FEAST Excel template and analyzed. Results are presented in tables, graphs, bar and pie charts.

Results and discussions

The following are the results of the assessment and existing opportunities in the area.

Farming Systems

Landholding categories

Farm sizes in the area were characterized as small scale (less than 0.4 hectares), medium scale (between 0.4 hectares and 0.8 hectares) and large scale (more than 0.8 hectares). Most of the households fall in the medium category (Figure 1).

Land in Gem is either inherited or bought and utilisation of ancestral land for fodder production is a challenge as households focus on staple food production giving little priority to fodder. Because of small landholdings very little land is used for forage production (20%). Land is barely left fallow due to the small land sizes but about 20% of the land is not utilized seasonally due to high cost of labour (this is usually set apart as grazing land and to allow regeneration). The rest of the land in the sub-County (80%) is used for food production. Farming land is hired at KES 500 (US $ 5) per year and this is mainly for staple food production. Farmers, however, feel that ideally 50% of total farming land, should be allocated to livestock feed and the other half to crop production; farmers with improved breed animals are increasing the hectares allocated to livestock feed production.

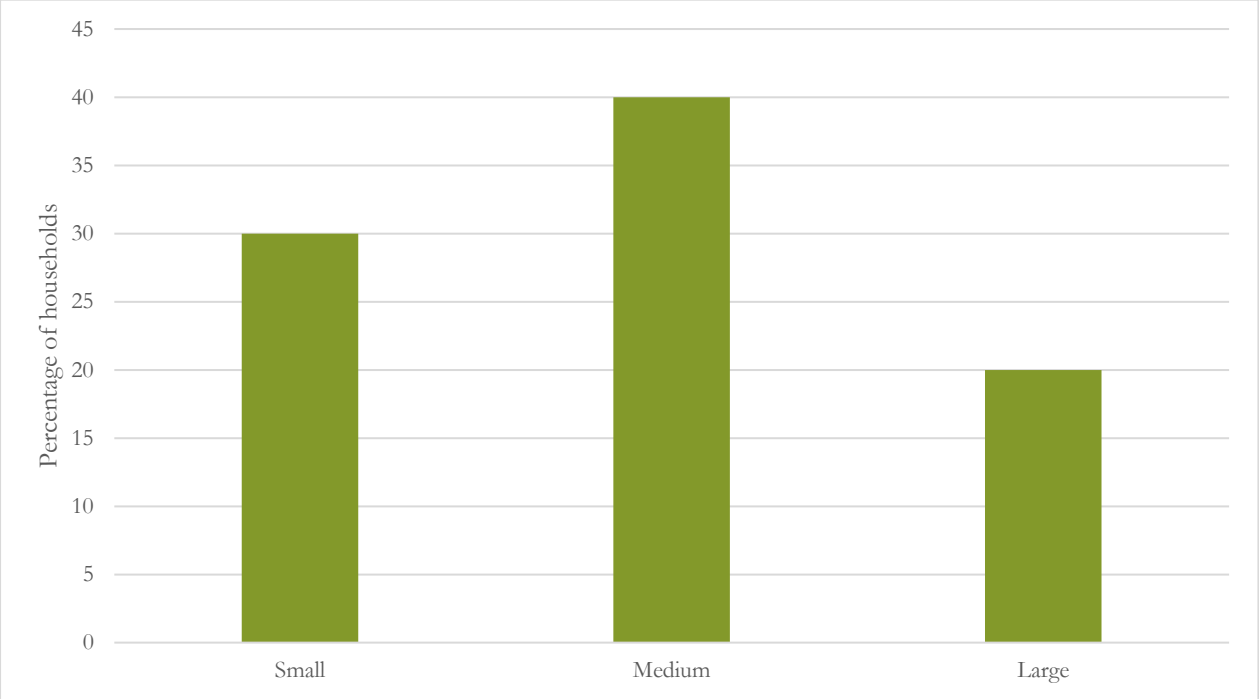

Figure 1: Households in different landholding size categories

Rainfall and cropping seasons

The area has three major seasons based on rainfall patterns that dictate farming activities (Table 1). Land preparation is carried out in the dry season that falls in the months of January, February and August. Early August and December is a time of harvesting. Long rains fall between March and July and this marks the onset of planting, followed by weeding and fertilization in subsequent months. Planting of Napier grass, bananas and trees is done during the long rains when there is a sufficient and sustained moisture level in the fields. A second planting season is in the month of September, which is the onset of short rains (Table 1).

Table 1: Rainfall season patterns

Name of season	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Long rains (Chwiri)												
Short rains(Opon)												
Dry Season (Oro)												

Dominant crops cultivated in Gem sub-County

Maize is the most dominant crop farmed by households in Gem sub-County and the main staple food (Figure 2). It is grown on an average of 0.26 hectares per household and the residues mainly go to animal feeding during dry seasons, with a little used for mulching. Beans, groundnuts, bananas and agro-forestry trees are also grown in most farms within the sub-County, on relatively smaller land areas compared to maize.

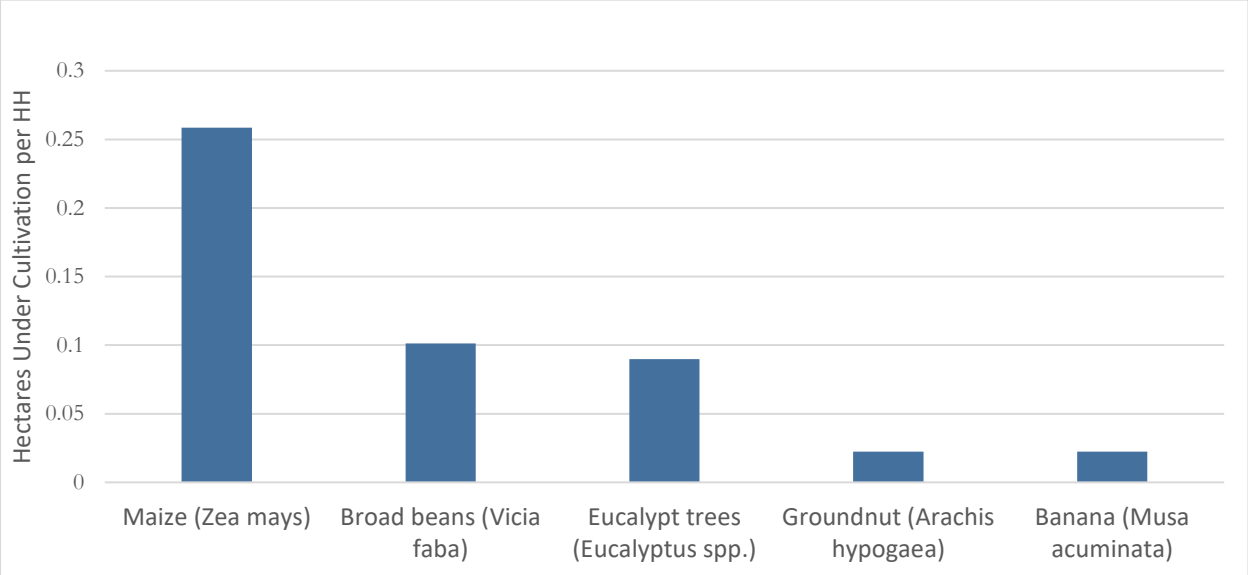

Figure 2: Dominant crop type by average area grown per household

Farm labour

Most households use family labour on the farms to save on production costs. Labour availability is about 40% during peak seasons, since people are keen on working on their own farms before moving out to work on the farms of others. Demand for labour is highest during land preparation, planting, weeding and harvesting. Labour for livestock related activities is required throughout the year. The price of labour does not vary with gender and costs KES 250 (US $ 2.5) per day inclusive of meals. Workers report at 7am and leave by 12pm. During harvest, the workers get a few tins of cereals in addition to their pay and food. Duration of time spent on a farm is jointly determined by the farmer and workers beforehand. Some farmers stated that labour costs are too high and that there is an increasing trend towards crop farming unprofitability.

Household income sources

Livestock farming is the largest source of income for households in Gem sub-County, contributing 53 % of total household income. Livestock income is from dairy, local poultry farming and sheep-and-goat enterprises. Cropping is the second most important source of income, contributing 29 % (Figure 3).

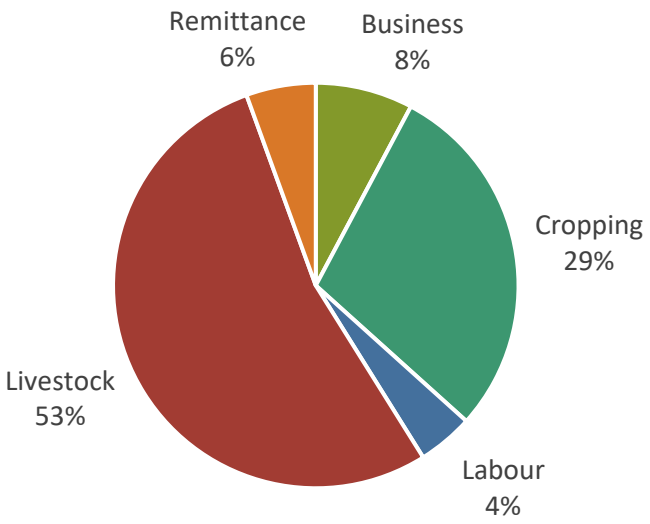

Figure 3: Average contribution of different livelihood activities to household income

Livestock farming systems

Most households in Gem sub-County are engaged in livestock farming activity and keep cattle, goats and local poultry. These are kept for milk, meat, manure, breeding and dowry. Improved dairy cows are the most dominant type of animal kept by households (Figure 4). This number is expected to rise due to efforts by the NGO Send a Cow, ILRI and the County government to inseminate viable local cows with exotic semen. Local Zebu cattle, however, are still valued for customary and traditional purposes. Local Zebu are reared by 60% of the farmers. Goat rearing is practiced as they are easily disposed of either through home slaughter or local sale during the seasons of low forage volumes and then repurchased when forage volumes are high. Local poultry is reared by most households with an average of 18 birds/household across all three land size categories.

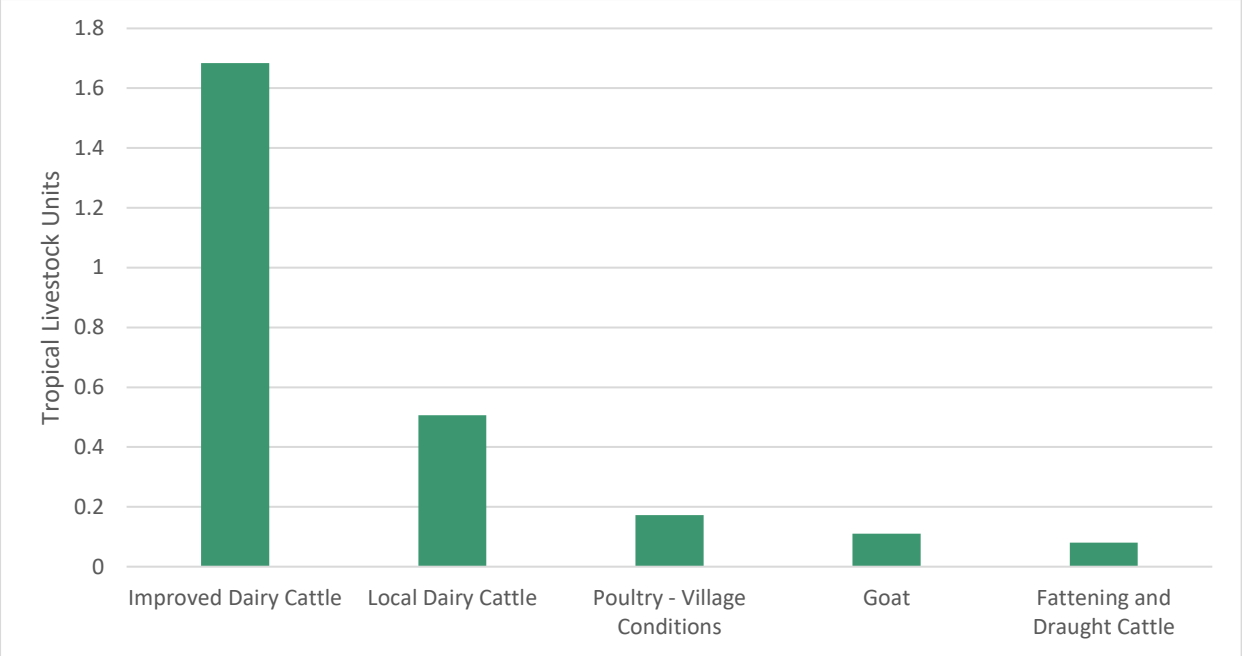

Figure 4: Dominant livestock categories

Livestock management practices

The most common animal housing structures are 'boma's in which animals are housed during the night, with no separation of animals by sex. Farmers with improved animals put up zero grazing units. Milking of local animals is done under trees or in simple sheds built in areas that are easily cleaned. Poultry are provided with water and feed troughs.

In cropping seasons animals are tethered to avoid damage to crops while poultry are housed in temporary day structures. Animals are taken to water points to access drinking water while those with improved cattle bring water into the animal units from rivers, shallow wells and streams.

Livestock are faced with several health problems such as ticks, East Coast fever, foot and mouth disease, Newcastle disease, fowl pox, 'gumboro' and 'lumpy skin' diseases. These are made worse by unreliable government veterinary services, forcing most farmers to use private service providers. Traditional veterinary practices are no longer common due to the effectiveness of modern veterinary medicine, although for poultry, farmers still offer herbal concoctions to birds before the onset of the dry season, which has a high prevalence of diseases. For breeding, use of bulls was preferred by 95% of the respondents due to the low service cost, as opposed to artificial insemination (AI). The cost of AI ranges between KES 1500 (US $15) to KES 3000 (US $ 30) and service delivery is associated with other problems of conventional semen, unreliable services, high rate of repeats as well as inexperienced service providers. However, bull services have the disadvantage of spreading venereal infections and promoting inbreeding.

Livestock feeding

Feed availability generally follows the rainfall pattern, increasing during the rainy seasons and decreasing during the dry seasons (Figure 5). Feed availability is highest during short rains due to utilization of cereal and leguminous crop residues from the previous season. Large quantities of green fodder are also available.

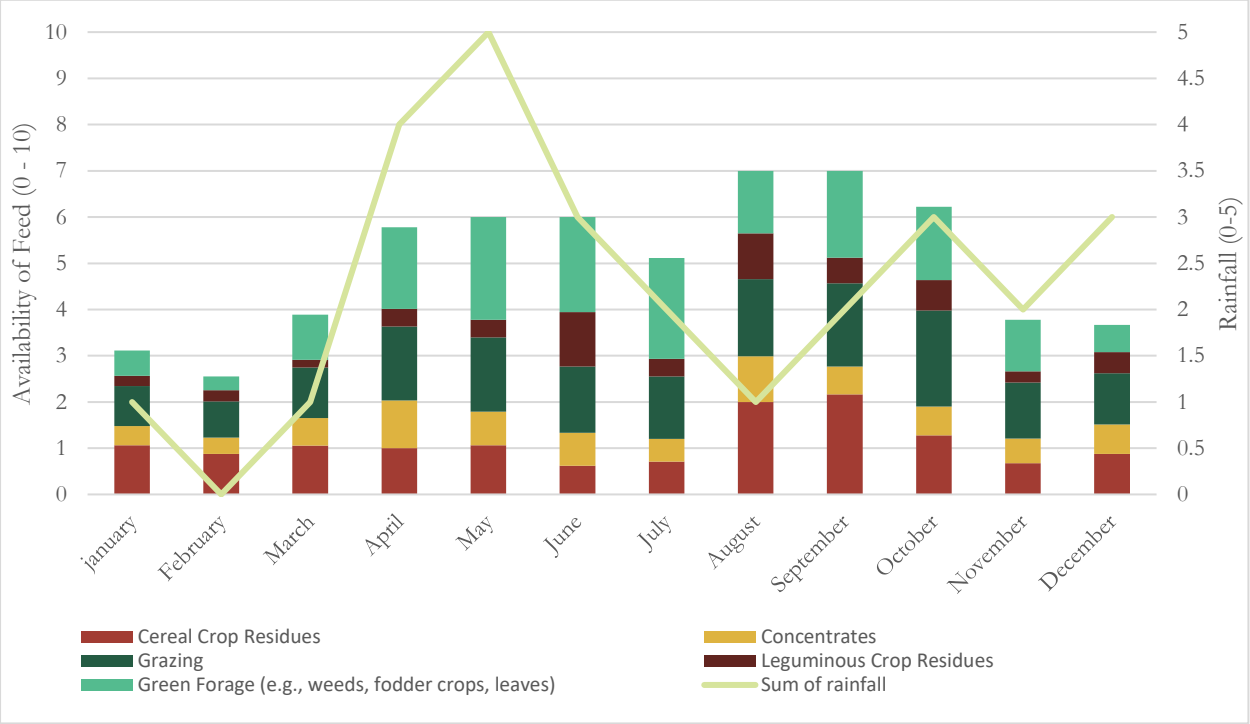

Figure 5: Annual rainfall pattern and corresponding livestock feed availability

On average, households plant Napier grass on 0.15 hectares of land (Figure 6) and it is the most dominant cultivated forage. This is below the recommended area and implies that farmers have to purchase bulk feed from outside the farm during the dry seasons. Napier grass also forms the bulk of purchased fodder, at about 920 kg/year. An average of 150 kg/year of sweet potato vines are also purchased. In the early dry seasons animals are fed with crop residues (Figure 5).

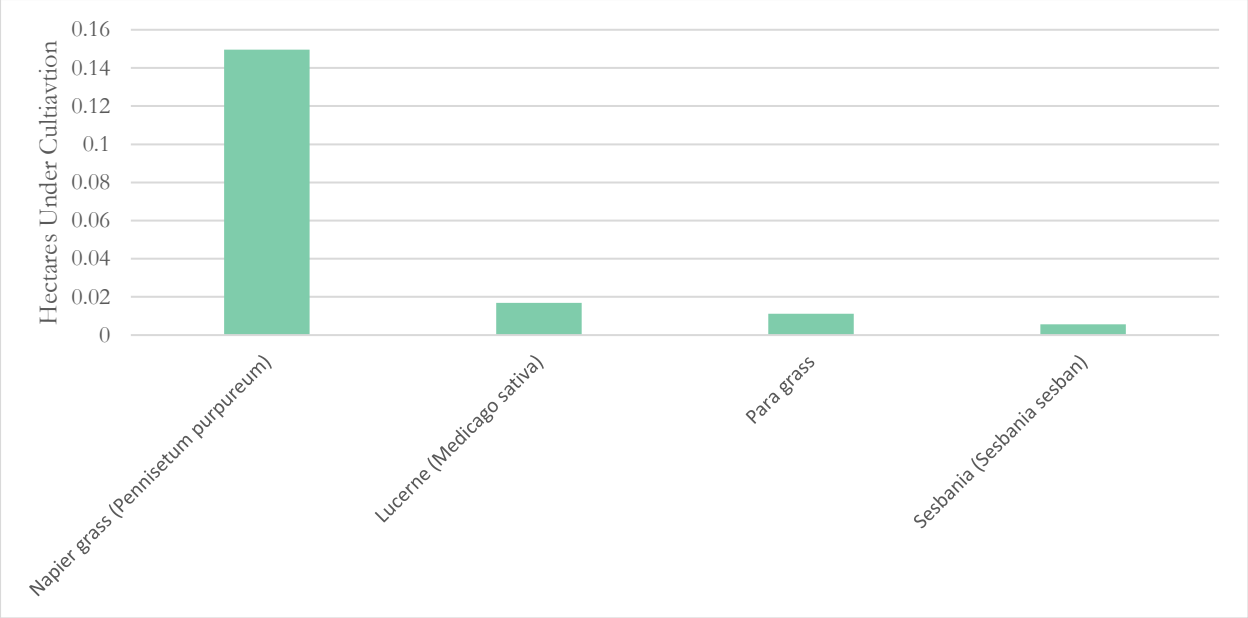

Figure 6: The four dominant fodder crops grown

Some farmers plant leguminous fodder species such as lucerne and Calliandra; improved sweet potato varieties are grown for both fodder and tubers.

Dietary composition

Grazing provides the highest amount of dry matter (DM) intake by animals (34%) (Figure 7a). However, it contributes 30% of crude protein (CP) to animal diets, lower than cultivated forage which contributes about 44% CP and 34 % of metabolisable energy (ME) (Figures 7b,c). Grazing is carried out along roadsides, on communal grazing lands, wetlands or family grazing sites which are mostly utilized during wet seasons. Collected fodder accounts for between 17–21 % of all three nutrient portions. Crop residues contribute only 12%, 7% and 11% to DM, CP and ME respectively.

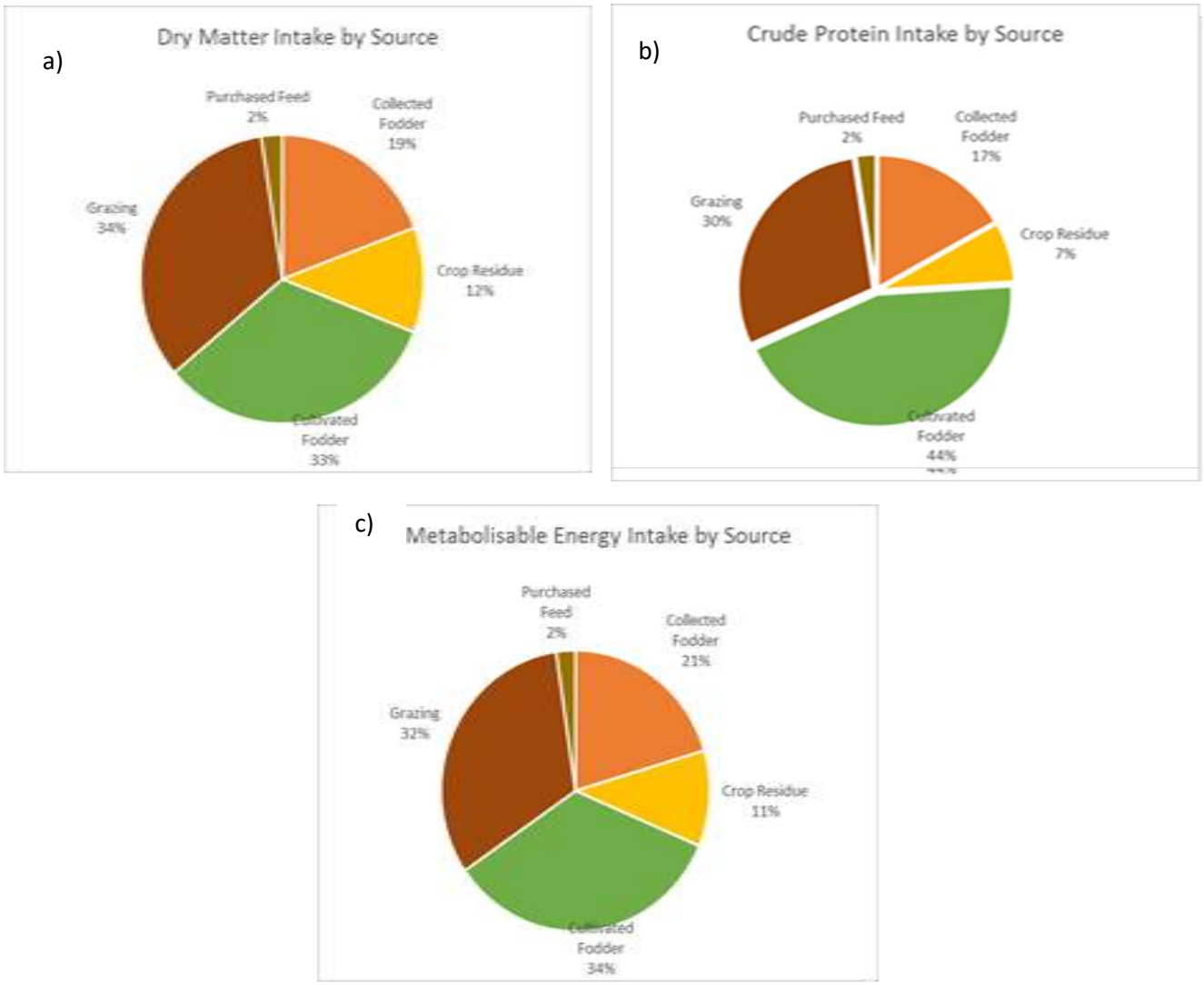

Figure 7: Sources of major livestock nutrients

Feed processing

Farmers with improved breeds process feed through chopping, addition of molasses or urea, or addition of enzyme to avoid feed wastage. Ration formulation is not practiced since the farmers buy cheaper commercial feeds rather than growing it on the farms. Female farmers are more open to processing than male farmers, with about 70% of them being involved in feed processing. However, only about 1% of farmers practice feed processing.

Key challenges and suggested interventions

The five top challenges identified by the community in order of importance are: high input costs (HIC), insufficient livestock feed (ILF), poor markets for farm produce (PM), unreliable veterinary services (UVS) and insecurity of farm animals (INS) (Table 2).

Table 2: Pairwise ranking

	HIC	ILF	PM	UVS	INS
HIC		HIC	HIC	HIC	HIC
ILF			ILF	ILF	ILF
PM				PM	PM
UVS					UVS

Proposed solutions suggested by farmers are detailed in Table 3 below.

Table 3: Proposed interventions

Challenges	Proposed interventions
High input costs	• Community to be involved in ward development budgeting to push for subsidies • Farmers to utilize available resources instead of purchasing inputs • Community to purchase in bulk through their cooperatives or groups • Link community groups and organizations with input suppliers for bulk purchasing • Train farmers on recycling of farm residues to increase fodder production.
Insufficient feeds	• Conservation of excess green feed and treatment of crop residues • Expanding land area under fodder production • Proper husbandry of feed plots • Train farmers on feed conservation and processing • Introduce new fodder species with higher nutritive quality • Bulking of new fodder species • Training on proper fodder husbandry • Capacity build trainee farmers to train others on silage and hay making • Introduce legumes into grazing fields • Form community M&E units
Lack of markets	• Networking with other farmers and stakeholders to access markets and market information • Marketing of products through marketing portals and agriculture department • Group marketing approach to be adopted • Contracted production of farm products • Network with all dairies in county for markets • Farmers to market milk through the dairy
Unreliable veterinary services	• Station officers to be at work over the weekends • Employ more staff by veterinary department • Training community health assistants • Reduction of veterinary costs • Ensure veterinary staff meet farmers regularly in the field
Insecurity of farm animals	• Insuring farm animals • Community policing

Conclusions

Farmers are willing to open up more land to fodder production and these should be targeted for improved grass species as well as legumes. While Napier grass is currently the most dominant cultivated species, interventions should be made to train these farmers on other fodder species, as well as incorporating leguminous fodder into grass fields. Grazing being the most common means of feeding, it could be improved by incorporating legumes in grazing fields or growing more nutritious grasses like Boma Rhodes.

Furthermore, farmers offer crop residues to animals but there is a need to train farmers on treating and processing these residues in order to increase their nutritional value.

Way forward and key areas of intervention

From the feedback discussion, key technological and institutional intervention issues were identified.

Technological interventions

- Train farmers on feed conservation.
- Introduce better quality and high yielding fodder varieties.
- Integrate legumes into grazing fields as well as in stands of pure pasture such as brachiaria, Napier or Boma Rhodes.
- Build capacity of trainee farmers on fodder conservation particularly hay and silage making.
- Expand green fodder fields.
- Utilize idle land for fodder production.

Institutional interventions

- Establish linkage between farmer organizations and input suppliers for low priced inputs.
- Build capacity of farmers to take part in county government budgeting. Push to prioritise animal feed issues to be included in the ward development budget.
- Liaise with all dairies in county for enhanced marketing.

References

Department of Livestock Production Annual Report (2015), Siaya County.

ILRI (2016). *Feed Assessment Tool (FEAST)* Available at: http://www.ilri.org/feast [Accessed 20 Jul. 2016].

Annexes

1.Context scoring

CONTEXT ATTRIBUTE	SCORE(0-4)
Availability of cash	2
Availability of input delivery	3
Availability of knowledge	2
Availability of labour	2
Availability of land for cultivating fodder	
Availability of water in growing season	2

0= Most important 4= Less important

2. Water source and seasonality

SOURCE	SEASONALITY	Distance
Roof catchment	Seasonal	1m
Springs	Seasonal/ permanent	0.5km
Streams	Seasonal/ permanent	0.5km
Boreholes	Permanent	0.5km
Shallow wells	Seasonal	50m
Rivers	Seasonal / permanent	1km
Dams	Seasonal/ permanent	0.5km

3. Labour

ACTIVITY	COST / DAY (KSHS)	
	MALES	FEMALES
LAND PREPARATION	250	250
PLANTING	250	250
WEEDING	250	250
TOP DRESSING	250	250
HARVESTING	250	250
CUTTING AND PROCESSING NAPPIER	150	150

4. Credit source and seasonality

SOURCE	SEASONALITY
KWFT	YEAR LONG
SMEP	YEAR LONG
TABLE BANKING	YEAR LONG
MERRY GO ROUND	SEASONAL
MSHWARI	YEAR LONG
KCB LOAN	YEAR LONG
VILLAGE LOANS AND SAVINGS	YEAR LONG
UWEZO FUND	YEAR LONG
ONE ACRE FUND	PLANTING SEASON

5. Inputs and input suppliers

SUPPLIER	INPUT TYPE
Agrovets and hardware	Farm implements.
Agrovets, Agriculture department, 1 acre Fund, on farm	Fertilizers, seeds, manure, pesticides, accaricides
KALRO, farms	Planting materials, livestock breeds
NGOs, agrovets, CDF	Irrigation pumps, spray pumps

6. Veterinary services

SERVICE	PROVIDER	DISTANCE	PRICE
Animal vaccination	Government vet	1km	USD 0.5/ animal
A.I.	Government vets Private animal health providers	5km	USD 7- USD 30
Clinical services	Government vets, private providers Quacks	1km	USD 3- 50
Deworming	Government vets, private providers, quacks	1km	USD 1.5/ animal

7. Livestock reproduction methods

Artificial insemination

A.I PROVIDER	PRICE (USD)	REPEAT RATE
Government vets	12	10%
Private providers	12- 25	10%

Bull services

PROVIDER	TYPE OF BULL	AVAILABILITY	AV PRICE (USD)
NYAWARA SEC. SCHOOL	FRIESIAN CROSS	100%	4
ULAMBA PRIMARY	AYRSHIRE CROSS	20%	5
LWANDA DUDI PRI.	FRIESIAN CROSS	100%	5
YAW PACHI COLLECTION CENTRE	FRIESIAN CROSS	95%	5