Characterization of the farming and livestock production systems and the potential to enhance productivity through improved feeding in Wolmera and Wuchale Districts, Ethiopia

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Background

The Feed Assessment Tool (FEAST) was used to characterize the farming and livestock production systems with a particular focus on the feed-related aspects in selected villages in Wolmera District and Wuchale District in Ethiopia. FEAST is a systematic method that utilizes a combination of informal group discussions and structured interviews with key farmer informants to rapidly assess on-farm feed availability in a smallholder context. The study was conducted by staff members from the Ethiopian Institute of Agricultural Research (EIAR), Holetta Research Center (HRC) in collaboration with the International Livestock Research Institute (ILRI) and International Center for Agriculture in Dry areas (ICARDA). The objectives of the study were to gain an understanding of the overall production system with a particular focus on the livestock feeding strategies employed by farmers in selected villages, to identify key areas of the feeding strategy that could be altered to improve livestock productivity, and to test FEAST at field conditions in selected villages.

Methodology

Study sites

The study sites were selected from two districts, Wolmera and Wuchale, by staff from EIAR as these areas have considerable potential for the development of dairy production. Wolmera District is located in West Shewa and Wuchale District is located in North Shewa.

Sampling method

Selection of villages

The selection of villages was conducted by Livestock Officers from the District Agricultural offices. Selection was based on the cattle production system and market orientation. Two villages were selected from each district. The villages of Berfeta Tokofa (GPS co-ordinates N09^{0}01'29'', E038^{0}30'43.3''), and Rob Gebeya (GPS co-ordinates N09^{0}07'39.3'' and E038^{0}63'5.5'') were selected from Wolmera District while Mechela Wertu (GPS co-ordinates N09^{0}34'15'', E038^{0}53'51.8'') and Bosoqa Jate (GPS co-ordinates N09^{0}29'01.9'' and E038^{0}52'36.8'') were selected from Wuchale District. Berfeta Tokofa from Wolmera District and Mechela Wertu from Wuchale District were selected for local breed based production systems and Rob Gebeya from Wolmera district and Bosoqa Jate from Wuchale district were selected to represent market oriented dairy production (crossbred cattle).

Selection of participants for the group discussion

Development agents and village chairmen of the selected villages selected farmers based on land ownership, gender and age. Engagement in market oriented dairy production was also a criteria in the case of crossbred cattle producing villages. Thirteen farmers (8 men and 5 women) from Berfeta Tokofa, thirteen farmers (11 men and 2 women) from Rob Gebeya villages, fourteen farmers (11 men and 3 women) from Mechela Wertu and thirteen farmers (10 men and 3 women) from Bosoqa Jate villages were selected for the study.

Selection of key informant farmers

Three farmers were selected from the participants of the group discussion from each village to carry out a further individual questionnaire. These key informant farmers were selected to represent the 3 main categories of wealth in their respective villages. Landholding was used to determine wealth. The three categories of wealth were below average landholding, average landholding, and above

average landholding. The cut-off point between the various wealth categories were determined by the farmers during the group discussions.

Survey structure and format

The surveys were conducted between 25th March and 20th April, 2012. The questionnaire was conducted in two sessions. The first session was conducted as a 2-hour informal group discussion consisting of open-ended questions in a semi-structured format. The second session of the questionnaire was a 1-hour structured interview. Key informant farmers responded to the questionnaires individually.

Data analysis

The FEAST excel macro program (www.ilri.org/feast) was used for data analysis. Narrative responses collected during the group discussions were examined and reported.

The Feed Assessment Tool (FEAST) is a systematic method to assess local feed resource availability and use. It helps in the design of intervention strategies aiming to optimize feed utilization and animal production. More information and the manual can be obtained at www.ilri.org/feast

FEAST is a tool in constant development and improvement. Feedback is welcome and should be directed feast@cgiar.org. The International Livestock Research Institute (ILRI) is not responsible for the quality and validity of results obtained using the FEAST methodology.

Major Findings

The results will be reported in two parts, A: Wolmera District whereby Berfeta Tokofa will represent the local breed based production system and Rob Gebeya will represent the crossbred dairy production system (market oriented) and B: Wuchale District whereby Mechela Wertu will represent local breed based production systems and Bosoqa Jate will represent the crossbred dairy production system (market oriented).

Findings: Wolmera District

Overview of the Farming Systems

The farming system is primarily a subsistence based crop-livestock mixed farming system where livestock in general and dairy production in particular contribute in Berfeta Tokofa and Rob Gebeya villages. The average farm size is 1-2 ha per household (Table 1) and households are composed of an average of about 6 members.

Table 1: Percentage of households that fall into various land size categories in Berfeta Tokofa and Rob Gebeya

Category of farmers	Range of land size (ha)	% of households that fall into the category	
		Berfeta Tokofa	Rob Gebeya
Landless	0	10	18
Small	Up to 1	24	21
Medium	1 – 2	41	50
Large	More than 2	25	11

There are two distinct cropping seasons, "*Keremt*" (the main rainy season) which occurs from June to September and "*Belg*" (short rains) which occurs from February to April, however, there is now a trend of diminishing short rains. Households in Berfeta Tokofa predominantly grow tef (*Eragrostis tef*), wheat (*Triticum aestivum*) and pulse crops which include chick pea (*Cicer arietinum*), grass pea (*Lathyrus sativus*) and lentils (*Lens esculenta*). In Rob Gebeya, barley (*Hordeum vulgare*) and tef (*Eragrostis tef*) are the predominant cereals; wheat is also grown. About 80% of the farmers in Berfeta Tokofa have access to irrigation. The predominant horticultural crops which include potato (*Solanum tuberosum*), cabbage (*Brassica oleracea*), and carrot (*Daucus carota*) are grown using irrigation. More than one crop is grown per year because of the access to irrigation. The farmers do not practice fallowing due to critical land shortage. In Rob Gebeya, only 3% of the farmers have access to irrigation, thus double cropping (barley-chickpea/grass pea) mainly depends on the amount and distribution of rainfall. Fallowing is practiced to maintain soil fertility. Agricultural inputs are available on the local market in both villages but low quality and un-affordability are some of the problems that limit their utilization. Both family and hired labor are used. The hired labor is on a daily and contractual basis. The other type of labor is "*debo*" (group labor from neighboring villages) but the trend is declining because they are expensive to hire. Labor is most required during periods of harvesting at a daily cost of 50 - 80 Ethiopian Birr (USD 2.9 – 4.6) inclusive of meals. There is an increasing shortage of hired labor as village people prefer to work in floricultural farms and cement industries in nearby towns.

Major Income Sources

Households generate their income in various ways. In Berfeta Tokofa which has predominantly local bred cattle, 70% of the income comes from horticultural crops. In Rob Gebeya, which has predominantly crossbred cattle, it is estimated that 57% of income comes from dairy production (Fig. 2).

Credit services are available in Berfeta Tokofa but due to lack of awareness and high interest rate, farmers do not use the services. They are also readily available in Rob Gebeya through Walqo Oromiya Micro finance, Africa Village and Liyu Financial Assistant but due to relatively high interest rates, farmers are not inclined to use the services.

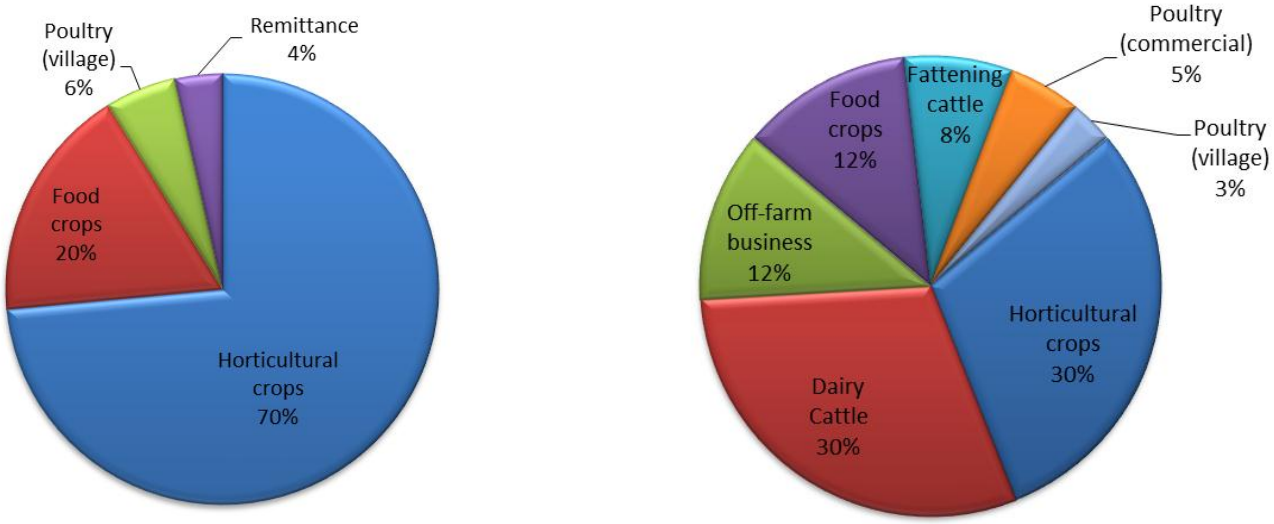

Fig. 1: Contribution (%) of livelihood activities to household income in Berfeta Tokofa (left) and Rob Gebeya (right)

Livestock Production Systems

Highland mixed zebu and Holstein Friesian are the predominant cattle breeds kept by households in both villages. In Berfeta Tokofa, the main livestock species kept by households are fattening, draught and local dairy cattle. Other animals include donkeys, horses, improved dairy cattle, goats and local chicken (Fig. 1A). In Rob Gebeya, the main livestock species kept by households are improved dairy cattle and local dairy cattle. Others include fattening cattle, horses, sheep, goats, indigenous and improved chicken (Fig. 1B). The local breed dairy cows in Berfeta Tokofa produce approximately 1.3 liters of milk per day. The milk is processed into butter and cheese for sale and home consumption. In Rob Gebeya, the crossbred cows produce 18 liters of milk per day. About 1.75 liters per day is retained for household use. The remaining milk is sold for an average of 6.7 Ethiopian Birr (USD 0.4) per liter. The majority of the households in both villages keep draught animals for draught power, manure, fuel, threshing and income generation. Sheep and goats are kept for income generation, home consumption and manure. Most households prefer to rear indigenous chicken as opposed to improved chicken because the latter require intensive management. Horses and donkeys are mainly owned by landless farmers for income generation by transportation. Apiculture is practiced by farmers in Berfeta Tokofa. Local (10%) and improved (3%) beehives produce honey for income generation as well as for home consumption.

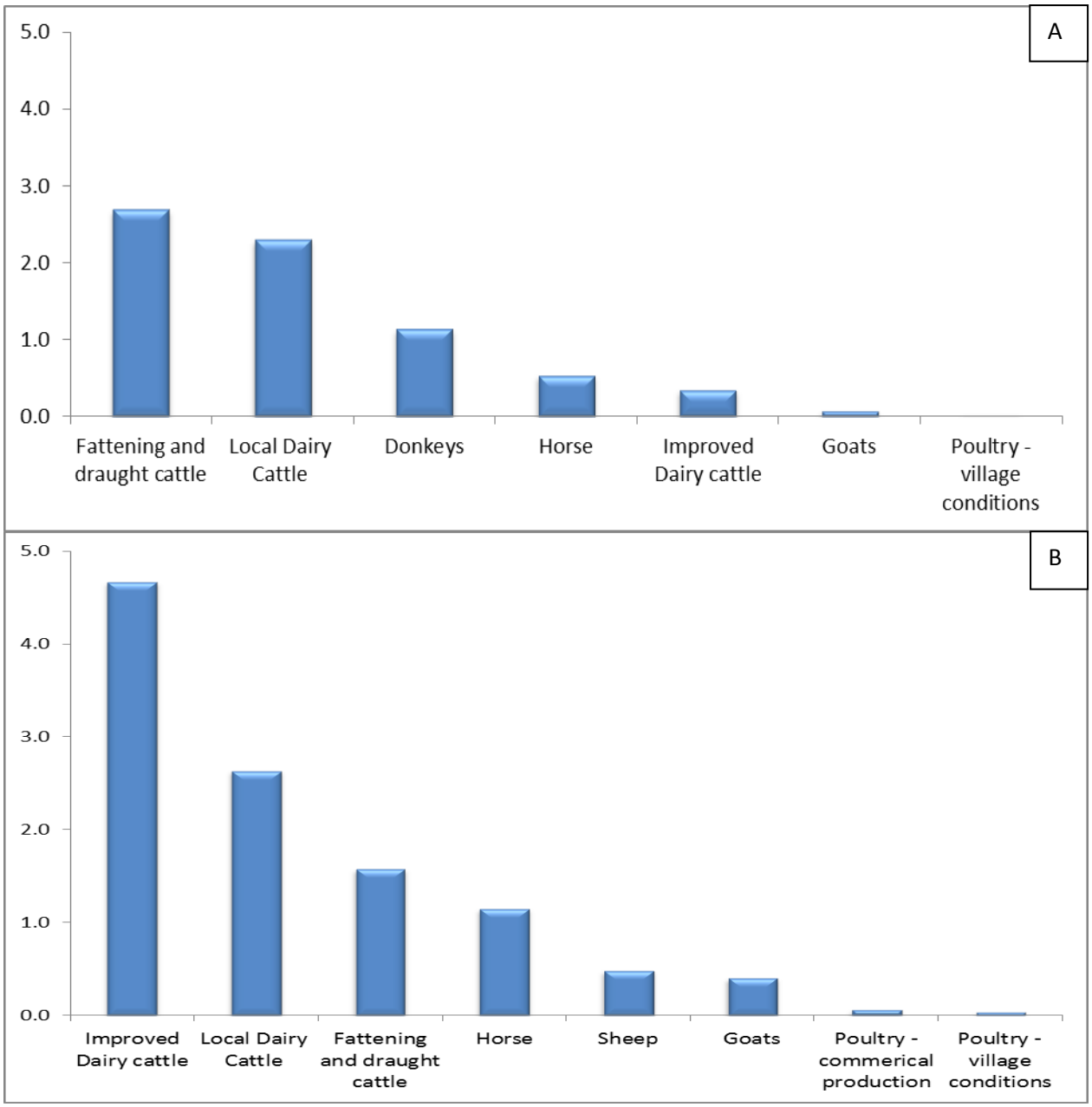

Fig. 2: Average livestock species holdings per household (TLU) in Berfeta Tokofa (A) and Rob Gebeya (B)

Farmers use open-air barns for local cows and in-door housing for crossbreds. The walls of the housing are mainly made from wood, the floor from earth and stone and the roofs are either grass-thatched or from corrugated iron. The main feeding strategies are stall feeding and open grazing though this depends on the type of breed. Local cows are open grazed and supplemented with tef straw in the morning and at night. Stall feeding is for crossbred dairy cows. Hay is supplemented with wheat bran and concentrates.

Veterinary services are available but not easily accessible by most farmers in both villages. The farmers in Berfeta Tokofa access the service after a 2-hour trek. Animals are vaccinated against foot and mouth disease annually. The cost is 1 ETB (USD 0.06)/animal. The farmers in Berfeta Tokofa do not use improved bull services because of the genetically small size of their cattle. In Rob Gebeya, farmers pay 4 ETB (USD 0.2) per AI service per animal. However, due to limited AI service, the farmers use crossbred bull service at a cost of 30 ETB (USD 1.7)/ animal.

Major Feed Sources

Rob Gebeya has a higher proportion of land under cultivated fodder compared to Berfeta Tokofa. Napier grass (*Pennisetum purpureum*) is predominant. Sesbania (*Sesbania sesban*) is also grown. In Berfeta Tokofa, oats (*Avena sativa*) and naturally occurring pasture are predominant. Others include sesbania and fodder beet (*Beta vulgaris*).

The diet of dairy animals is composed of a number of key elements as shown in Fig.3. Purchased feed contributes the largest proportion to the dry matter (DM), metabolisable energy (ME) and crude protein (CP) content of the diet in Berfeta Tokofa. In Rob Gebeya, cultivated fodder contributes higher proportions to DM and ME content of the diet, although the highest contributor to the CP content of the diet remains purchased feeds. Cultivated fodder is fed only during the long rainy season (Fig. 4). Farmers use "*atela" a* by-product of local brewing as a concentrate feed throughout the year in Berfeta Tokofa. Farmers are aware that urea treatment and chopping of the straw could be used to improve the quality of the straw, however, none of the farmers attempt to use the methods due to cost, time and labor constriants.

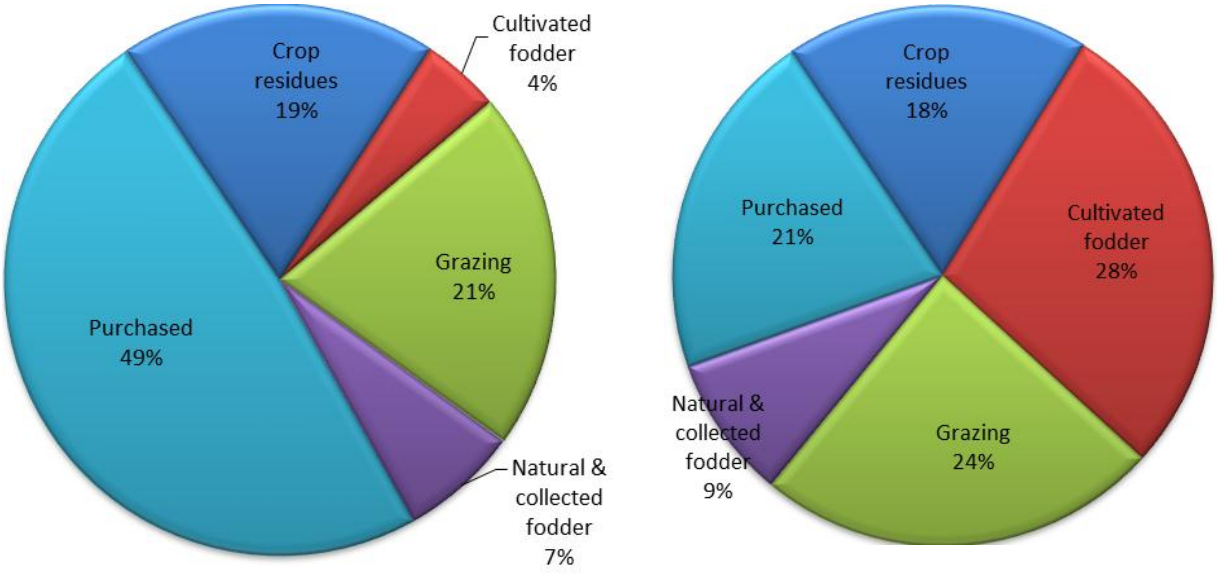

Fig. 3a: The contribution of feeds to total dry matter content of the total diet in Berfeta Tokofa (left) and Rob Gebeya (right)

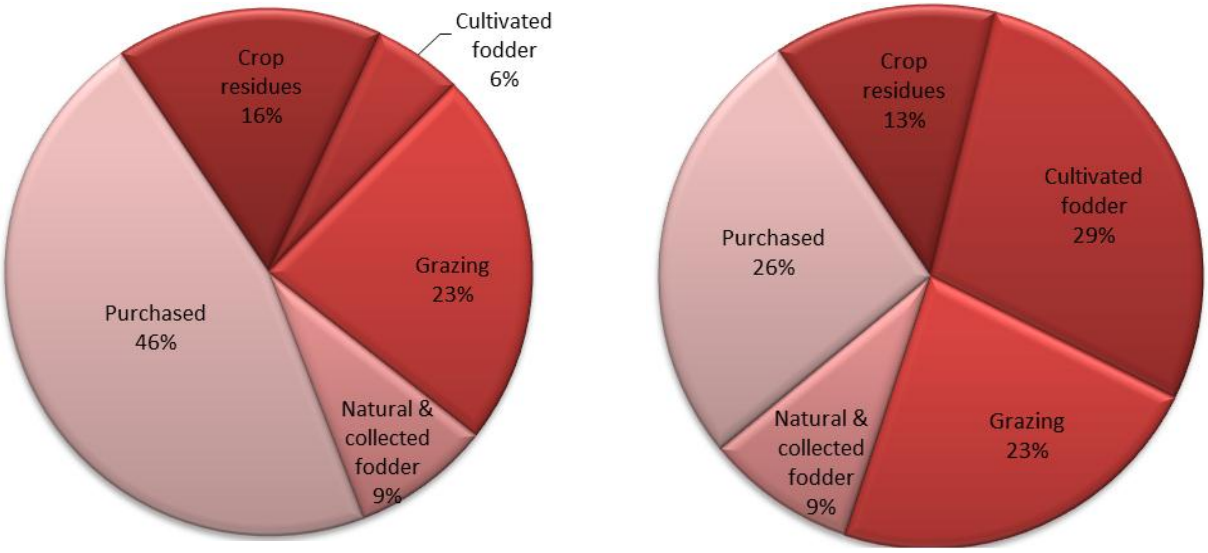

Fig. 3b: The contribution of feeds to metabolisable energy of the total diet in Berfeta Tokofa (left) and Rob Gebeya (right)

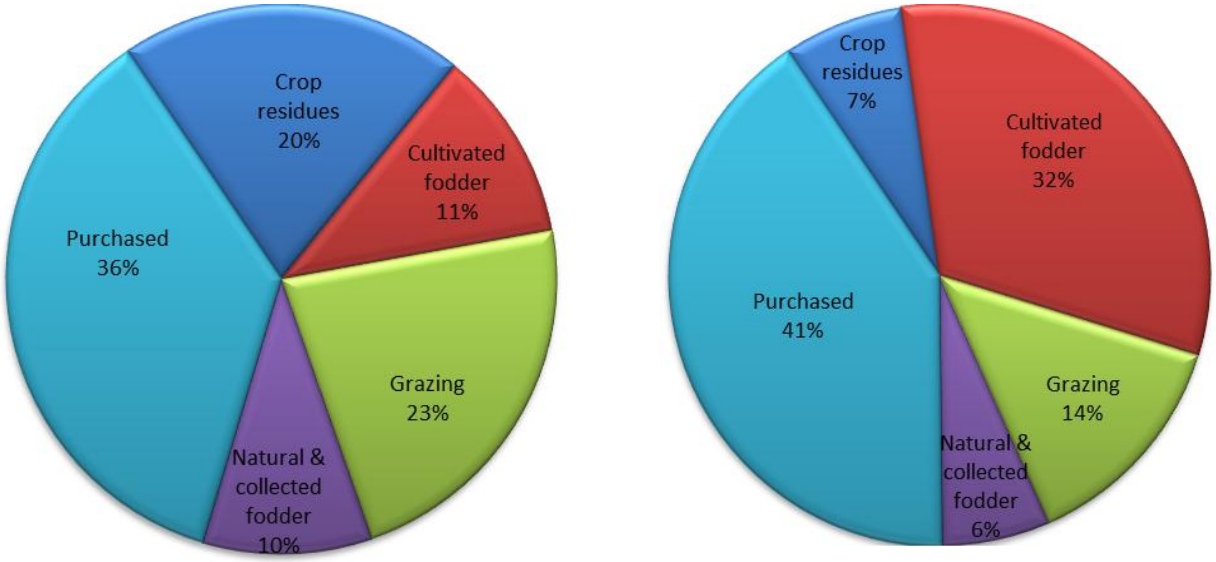

Fig. 3c: The contribution of feeds to crude protein of the total diet in Berfeta Tokofa (left) and Rob Gebeya (right)

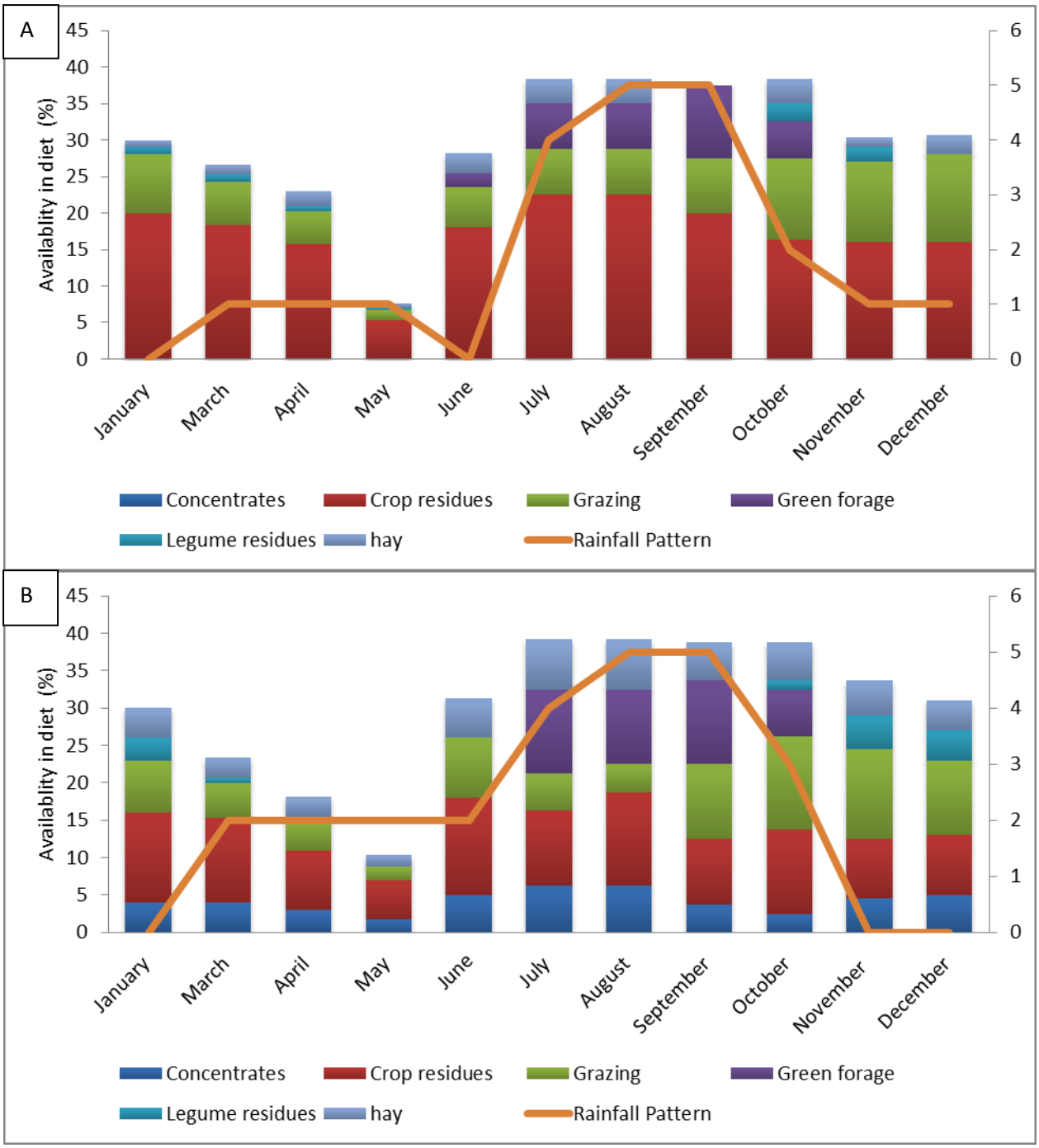

Fig.4: Seasonality of feed resource availability relative to the rainfall pattern in Berfeta Tokofa (A) and Rob Gebeya (B)

Problems, Issues and Opportunities

Farmers identified feed as their major problem. Farmers in Rob Gebeya identified this problem indirectly in relation to the high cost of milk production *vis a vis* cost of milk (Table 2B). Lack of genetically improved animals and disease were other problems highlighted.

Summary: Berfeta Tokofa

Key issues

- Feed shortage in both quality and quantity
- Poor extension service/knowledge gaps
- Lack of breed/AI service
- Inadequate vet service

Key metrics

- Milk yield: 485 liters per household per year
- Milk price: No sales of milk in the area (Processed into butter and cheese)

Table 2: Problems identified by farmers as limiting livestock productivity and farmer proposed solutions in Berfeta Tokofa (A) and Rob Gebeya (B)

A.

Problem (in order of importance)	Problems identified	Farmer proposed solutions
1	Feed shortage	▪ Plant improved forage crops in backyards, around fence and on farm sides ▪ Reduce the herd size ▪ Improve the utilization of straws (urea treatment, *atela* supplementation) ▪ Train on feed formulation
2	Limited knowledge/awareness	▪ Continued training of farmers
3	Lack of genetically improved breeds	▪ Access to A.I services
4	Disease	▪ Training of community animal health workers

B.

Problem (in order of importance)	Problems identified	Farmer proposed solutions
1	Low milk price/ high cost of milk production	▪ Efficient utilization of available feed through ration formulation ▪ Increase biomass production of food-feed crop on-farm and purchase more concentrate feeds ▪ Backyard cultivation of improved forage crops ▪ Reduce the herd size
2	Limited access to A.I services	▪ Improve availability of AI, semen ▪ Stationing AI service providers near the village ▪ Use of improved bull
3	Disease	▪ Increase farmer awareness of the important disease, preventive techniques and quarantine procedures ▪ Veterinary services to be close to the village ▪ Strengthen Ethno-veterinary services

Way forward

- Introduce simple feed processing technology such as chopping to improve the quality of straws.
- Use of crop residues from horticultural crops.
- Introduce appropriate fodder conservation methodologies as excess green fodder is produced during rainy seasons.
- Introduction of multipurpose trees (MPT) to ensure green fodder materials can be produced during dry period.
- Strengthen the capacity of extension services to provide training and support to farmers.
- Improve access to veterinary and AI services at each village with all necessary drugs and equipment.
- Provide farmers with training on a wide range of topics related to dairy production (including animal health, reproduction and nutrition) to enable them understand why their cows are not producing high volumes of milk

Summary: Rob Gebeya

Key issues

- Low milk price but high cost of milk production
- Trekking of long distances to fetch water from watering points
- Lack of feed availability both in terms of quantity and quality
- Inefficient AI service providers limiting the rate of breed improvement
- Few animal health services providers

Key metrics

- Milk yield: 6520 liters per household per year
- Average milk price: 6.73 birr per liter.
- Average retained milk: 1.75 liters per day

Way forward

- Train farmers in key areas of nutrition to improve their on-farm feed utilization ability.
- Decrease the reliance on purchased feeds through increased fodder production, higher yielding fodder varieties and introduction of fodder trees.
- Improve farmer training in disease control measures.

Findings: Wuchale District

Overview of the Production Systems

The farming system in Mechela Wertu and Bosoqa Jate villages is primarily a subsistence-based crop-livestock mixed farming system. The majority of farmers in Mechela Wertu are landless, whereas the average farm size per household in Bosoqa Jate is more than 2 ha (Table 3). Households are composed of 8 members on average. There are two distinct cropping seasons, "*Keremt*" (the main rainy season) which occurs from June to September and "*Belg*" (short rains) which occurs from February to April.

Table 3: Percentage of households that fall into various land size categories in Mechela Wertu and Bosoqa Jate

Category of farmers	Range of land size (ha)	% of households that fall into the category	
		Mechela Wertu	Bosoqa Jate
Landless	0	40	14
Small	Up to 1	15	11
Medium	1 – 2	16	23
Large	More than 2	27	48

Households in the area commonly grow a variety of cereal and pulse crops. Wheat, tef and oats are predominant cereals in Mechela Wertu and wheat, tef and barley are predominant in Bosoqa Jate. About 60% of the farmers in Mechela Wertu use irrigation for the cultivation of horticultural crops such as carrot, cabbage and potato during off-season for income generation and home consumption. Farmers living in Bosoqa Jate are mainly dependent on rainfall for production of crops because irrigation is not available in the area. Family, hired, and "*debo*" (group labor from neighboring) labor are available in both villages during crop and hay harvesting periods. Labor is mostly required during peak harvesting period (October to December) at a cost of 50 ETB (USD 2.9). High movement of community members for work and education to nearby cities causes critical labor shortage especially during peak harvesting seasons.

Major Income Sources

A major proportion of income from Mechela Wertu is from fattening cattle (60%) and fattening sheep (23%). Farmers in Bosoqa Jate, predominantly keep crossbred cattle and derive most of their income from dairy cattle production (72%) and fattening sheep (21%). Credit services are available from both formal (Walqo Oromiya Micro Finance) and informal sources (Hunde). More than 50% and 65% of the farmers Mechela Wertu and Bosoqa Jate respectively use the formal and informal credit services for purchase of various agricultural inputs.

Livestock Production Systems

Farmers in Mechela Wertu keep local breed cattle mainly for draught power, manure, threshing and income generation. These cattle produce about 4.5 liters of milk per day, about 0.5 liters of which is consumed in the households. The rest is sold for 6.75 ETB (USD 0.4) per liter. Crossbred dairy animals in Bosoqa Jate produce 13.8 liters of milk per household on average. About 1 liter is retained for household consumption and the rest is sold for 5.8 ETB (USD 0.3) in local markets. All households

keep sheep for home consumption, manure or they are fattened for sale. Indigenous chicken (85%) and improved chicken (5%) are reared for income generation and home consumption. Horses and donkeys are owned mostly by landless farmers for transportation and income generation through cart pulling. Fig. 5 shows the livestock species in Mechela Wertu (A) and Bosoqa Jate (B).

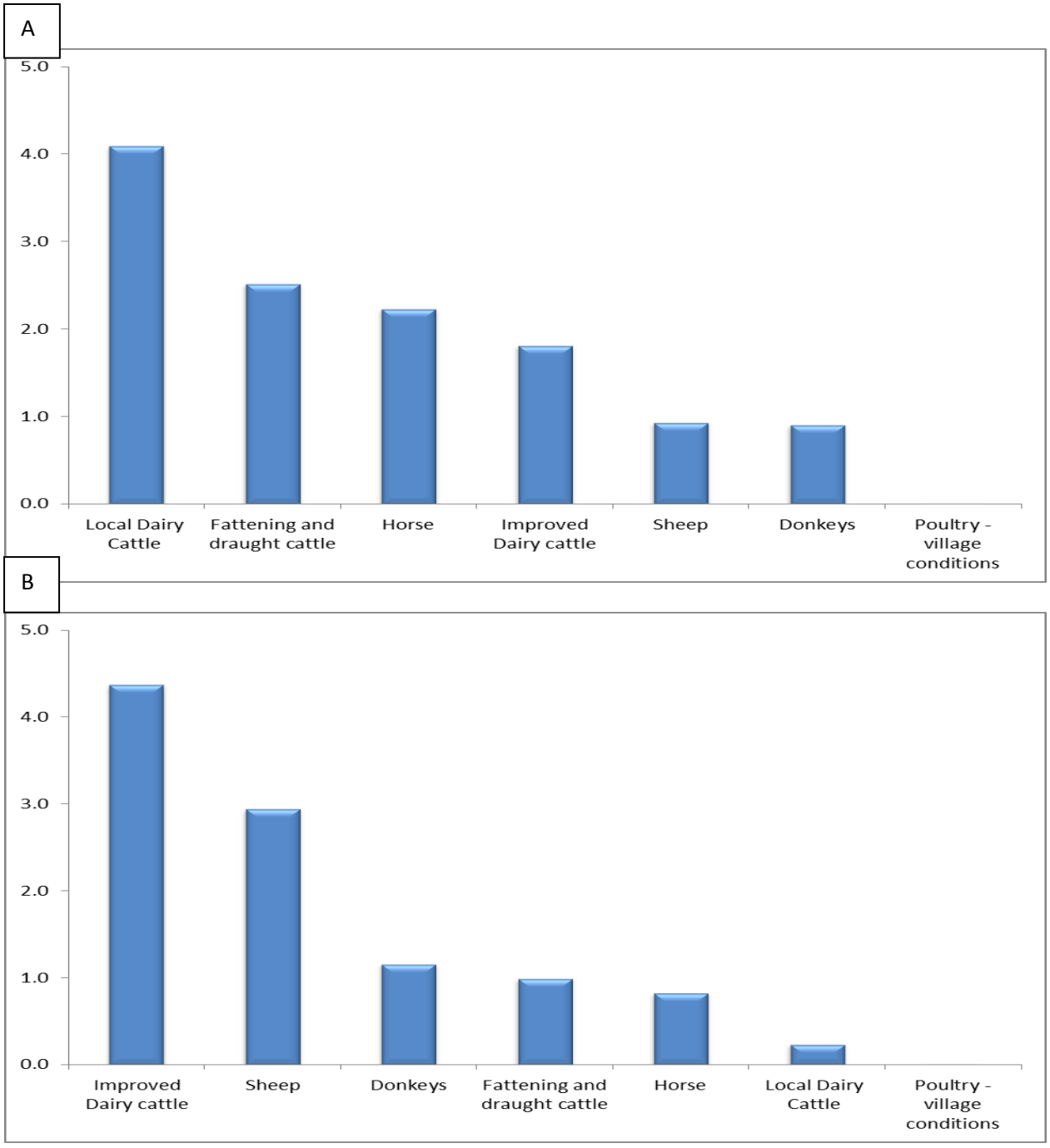

Fig. 5: Average livestock species holdings per household (TLU) in Mechela Wertu (A) and Bosoqa Jate (B)

Most of the farmers in both villages use thatched housing for their livestock. In Bosoqa Jate, some farmers use corrugated iron sheet for roofing their barns. Grazing is the main form of feeding. It is supplemented by crop residues and grasses during the night. Open grazing is practiced for both local and improved breeds whereas stall feeding is mainly for supplementation of crossbred dairy cows. Feed processing like threshing, mixing of straws with *atela* and oil seed cake are practiced mainly for

improved dairy cows. In Mechela Wertu, veterinary service is available after a 2-hour trek. There is an animal health center in Bosoqa Jate, constructed by the Hunde project, however, the service is not adequate due to the wide area the single technician of the project has to cover. AI service is available at a cost of 4 ETB (USD 0.2) but the service is not adequate due to shortage of semen and technicians. The average rate of repeat for AI service is 2 to 3 times in both villages. Local and improved bull services are available and are more commonly used by farmers. The cost of using an improved bull is 10 ETB (USD 0.6) per service in Mechela Wertu and 20 ETB (USD 1.2) in Bosoqa Jate. Local bull service is usually free in the villages.

Major Feed Sources

The contribution of feed resources to the dry matter, metabolisable energy and protein content of livestock diets is shown in Fig. 6. Grazing, crop residues and cultivated fodder contribute the largest proportion of the feed base to DM and ME contents of the total diet, whereas protein in the diets is mainly from purchased feeds. Many farmers are aware that urea treatment and chopping of the straw are some of the methods that could be used to improve the quality of the straw, however, none of the farmers attempt to treat and chop the residues in Mechela Wertu due to cost, time and labor constraints. Due to critical feed shortages, farmers in both villages feed all available straw to livestock. Feed from grazing land drastically reduces during dry season in April-May and green fodder is fed only during the rainy season (Fig. 7). Farmers also use *atela,* a by-product from local brewing as a concentrate feed throughout the year in Mechela Wertu.

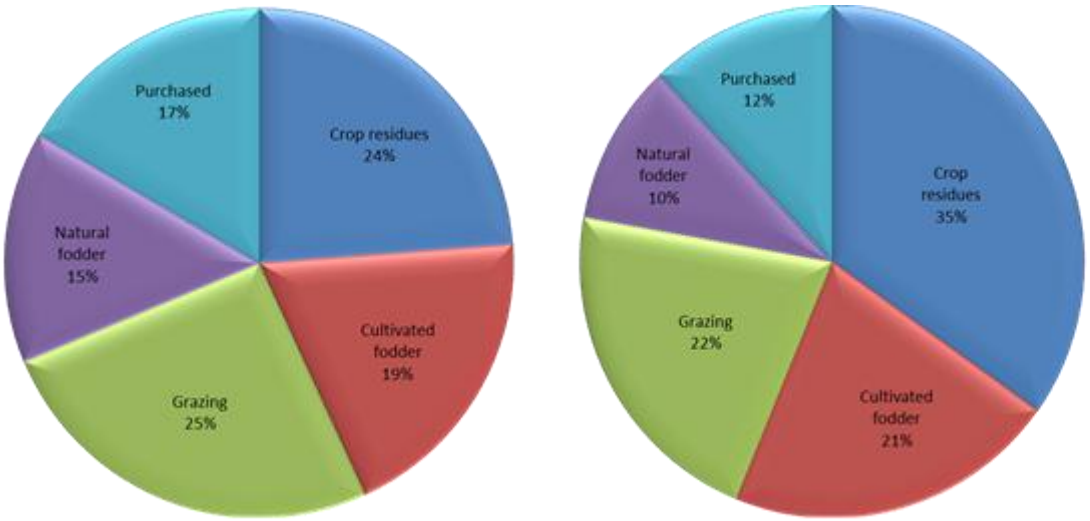

Fig. 6a: The contribution of feeds to total dry matter content of the total diet in Mechela Wertu (left) and Bosoqa Jate (right)

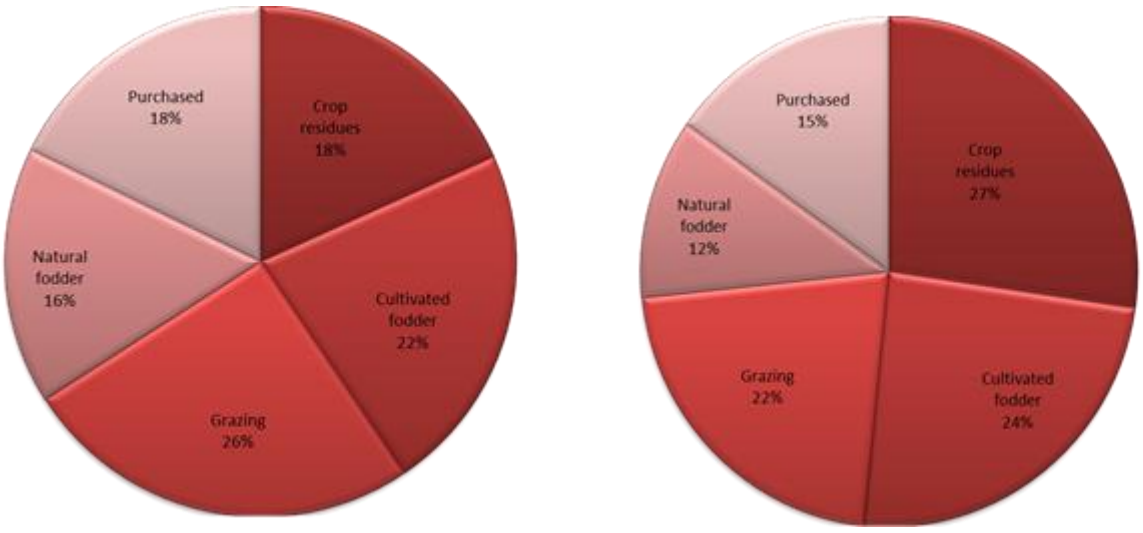

Fig. 6b: The contribution of feeds to total metabolisable energy of the total diet in Mechela Wertu (left) and Bosoqa Jate (right)

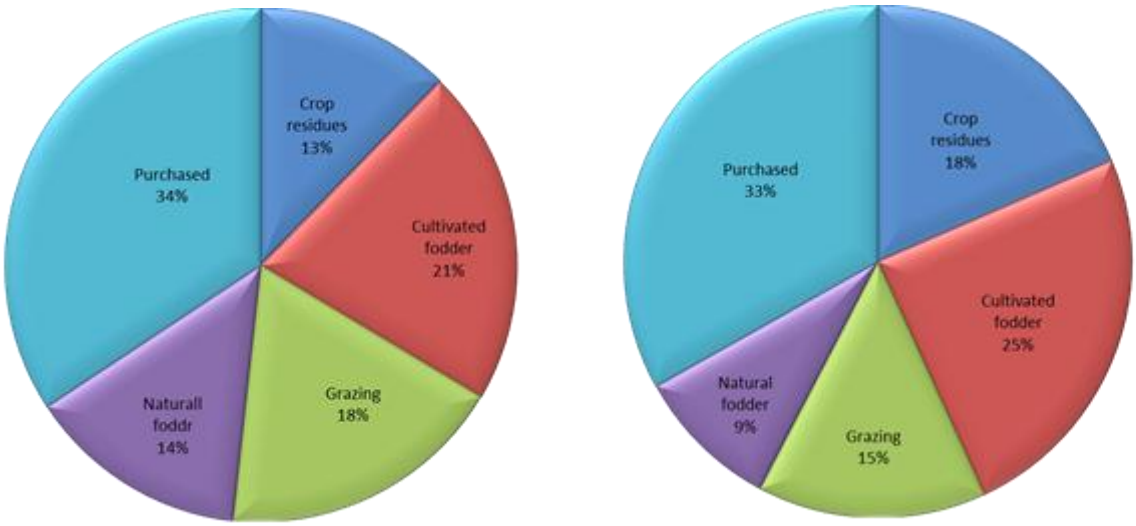

Fig. 6c: The contribution of feeds to total crude protein of the total diet in Mechela Wertu (left) and Bosoqa Jate (right)

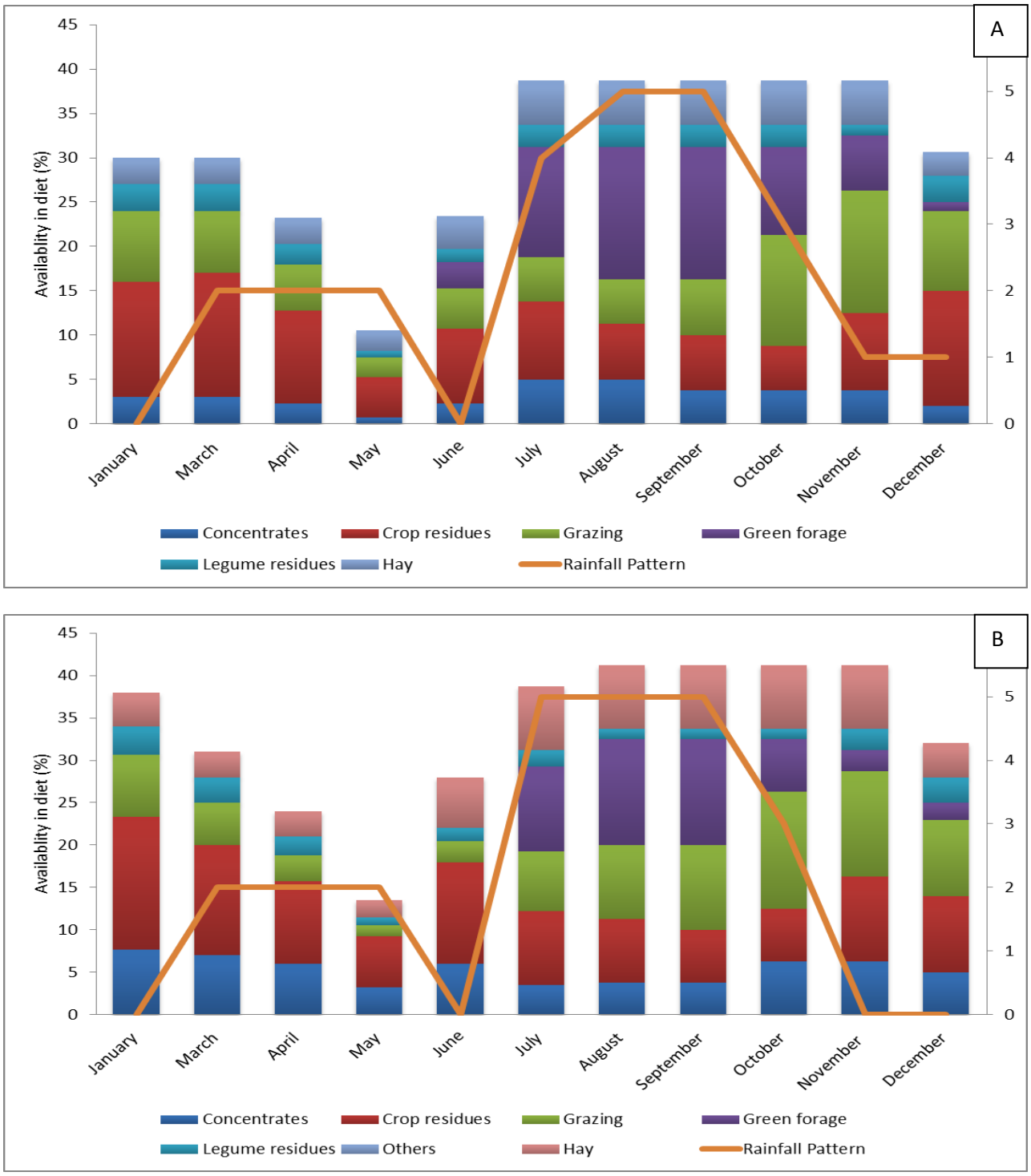

Fig. 7: Seasonality of feed resource availability relative to the rainfall pattern in Mechela Wertu (A) and Bosoqa Jate (B)

Problems, Issues and Opportunities

Farmers identified feed as their major problem. Farmers in Bosoqa Jate identified this problem in relation to the high cost of milk production *vis a vis* cost of milk (Table 4B), probably because they keep mainly crossbred animals and milk production is an important income source. Lack of genetically improved animals and disease were other problems highlighted.

Summary: Mechela Wertu

Key issues

- Feed shortage in both quality and quantity
- Lack of breed/AI service
- Poor extension service/Knowledge gaps
- Inadequate vet service

Key metrics

- Milk yield: 1660 liters per household per year
- Average milk price: 6.75 birr per liter.
- Average retained milk: 0.48 liter per day

Table 4: Problems identified by farmers as limiting livestock productivity and farmer proposed solutions in Mechela Wertu (A) and Bosoqa Jate (B)

A.

Problems (ranked)	Problems identified	Farmer proposed solutions
1	Feed shortage (poor quality, shrinking grazing lands, high cost)	▪ Urea treatment of crop residues ▪ Increase biomass yield of forage crops ▪ Use of oats grain as feed ▪ Reduce herd size
2	Animal health/disease (lack of vet service, internal & external parasites)	▪ Increase farmer awareness and education on disease and vaccinations ▪ Establishment of an animal health center in the village ▪ Increase number of veterinary service providers
3	Lack of genetically improved breeds	▪ Improve AI provision

B.

Problem (in order of importance)	Problems identified	Farmer proposed solutions
1	Low milk price/ high cost of milk production	▪ strengthen the capacity of cooperatives to add value to milk and milk products
2	Animal health/disease (internal & external parasites)	▪ Increase in number of animal health technicians
3	Lack of genetically improved breeds (limited AI)	▪ Increase in numbers of AI technicians ▪ Introduction of improved bulls

Way forward

- Introduction of multipurpose trees (MPT) to ensure green fodder materials can be produced during dry period.
- Introduce appropriate fodder conservation methodologies in the area, if excess green fodder is produced, during wet periods.
- Establish improved access to veterinary and AI services providing centers at each village with all necessary drugs and equipment

Summary: Bosoqa Jate

Key issues

- Low milk price but high cost of milk production
- Trekking of long distance for fetching of water from watering point
- Lack of feed availability both in terms of quantity and quality
- Inefficient AI service providers limiting the rate of breed improvement
- Limited animal health services providers

Key metrics

- Milk yield: 5030 liters per household per year
- Average milk price: 5.82 birr per liter.
- Average retained milk: 0.99 liter per day

Way forward

- Strengthening farmer cooperatives and unions with AI equipment and facilities.
- Decrease the reliance on purchased feeds through increased fodder production and higher yielding fodder varieties.
- Train farmers in key areas of nutrition to improve their on-farm feed utilization ability.
- Improve farmers training in disease control measures.

Lessons learned from the FEAST tool

- Using more key informants may give more representative results
- It saves time in designing intervention strategies aimed at optimizing feed utilization and animal production
- The strengths, weaknesses and opportunities of the tool are shown in Table 5.

Table 5: Strengths, weaknesses and opportunities of the FEAST tool

Strengths	**Weaknesses**	**Opportunities**
▪ It is systematic and rapid tool ▪ Captures livelihood issues ▪ It helps to identify farmers problems and farmer solutions ▪ It is good to facilitate discussion/participation ▪ It offers an opportunity to educate farmers ▪ It offers a comprehensive discussion guide	▪ Individual sample size is too small/farmer ▪ It is knowledge intensive (needs experts) ▪ Productivity parameters limited to milk ▪ lack of clarity on spatial scale ▪ It allows data input from a max of 6 individuals	▪ Needs to be adapted to pigs/small ruminants value chains ▪ Can be used to capture past development activities and scope/successes/failures; potential linkages ▪ Can collect larger individual data through group facilitation (farmers facilitated to fill individual questions) ▪ Enhanced promotion and training on the tool (especially to development partners) ▪ Constraints can be related to production factors