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Original Research

Feeds Availability, Nutrient Content and Utilization at Sasiga District and Uke town, East Wollega zone, Oromia, Ethiopia

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Abstract

Feed resources, nutrient content, and livestock productivity were studied in Uke town and Sasiga district, East Wollega zone, Oromia, Ethiopia. To determine feed resources, 150 random respondents participated. Data was collected using a semi-structured questionnaire. Livestock-producing areas were purposely chosen for the study. We assessed the nutritional value of key feed suppliers following identification. Researchers compared stocking rate to feed resources at research sites. Different feed suppliers have different dry matter yields. Due to their increased dry matter output, private grazing areas were managed differently than communal ones. We estimated feed availability by assessing each feed resource's DM production. Sasiga had a 5,467,345-tonne feed shortage, while Uke had -2,239.5 tones. The analysis suggests that local feed resources are insufficient to support the current livestock species. Thus, feed development, conservation, and use must be handled. This study indicated a feed deficiency, so improving feed quality is also important.

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INTRODUCTION

An opportunity to profit from the sector may arise in emerging nations like Ethiopia, where the demand for human consumables of animal origin is periodically increasing owing to human population expansion, rising incomes, and urbanization (Thornton, 2010). Despite these advantages, livestock resources contribute disproportionately little to human nutrition and export earnings. This is because animals produce less than the average for the region and the continent, largely because of poor feed quality and an inadequate supply (Berhanu et al., 2007; FAO, 2010; Getahun et al., 2010; FAO, 2001; Behnke & Metaferia, 2011).

In the mixed crop-livestock system, traditional fattening practices often target male animals and females that are either no longer fertile or have completed their reproductive cycle. Whereas crop leftovers play a pivotal role in the highland agro-pastoral system as animal feed, grazing is the dominant feed source in the lowland system.

The majority of the country's feed comes from agro-industrial waste, agricultural wastes, and natural pastures. The continuous conversion of grazing land to crop land is further exacerbating the country's feed deficit for animals, as natural pasture is occasionally diminishing in contribution owing to poor management and the continual rise of crop cultivation. This shows that low-quality agricultural leftovers are the only feeds available (Zewdie and Yosef, 2014), hence we need to find other sources of feed. Ruminant cattle rely on crop wastes for around half of their feed during the year, with that percentage rising to as much as 80% in the dry season in the Ethiopian highlands (Adugna, 2007). The animals have insufficient nutrition supply, low productivity, and even weight loss due to the high fiber content, moderate digestibility, and low nitrogen levels of these feed supplies (Tsigeyohannes, 2000; Hindrichsen et al., 2004). Based on the crop species, the nutritional content and productivity of crop leftovers might differ across locations and agroecologies. Despite the foregoing, research and documentation of the feed resources available to, used by, and nutritional content in the Sasiga districts, Uke town, and the surrounding areas have not yet been completed. Therefore, small-scale fatteners in Sasiga district, Uke town, and the surrounding areas commissioned this study to investigate the accessibility, nutritional value, and utilization of the most important feed materials utilized by them.

MATERIALS AND METHODS

Location of the Study

Research took place in the Uke town and adjacent areas of Sasiga district in the East Wollega Zone of Oromia Regional State, Ethiopia. The research region is shown on the map in Figure 1. The locations were chosen due to the abundance of farmers who engage in traditional dry-season cattle fattening practices. Of the seventeen districts that make up Oromia Regional State's East Wollega zone, Sasiga is one. Nekemte, the capital of the East Wollega Zone, is situated approximately 18 km west of the district, whereas Addis Ababa is approximately 343 miles west. Digga district to the south, Benishangul Gumuz Regional State to the west, and Guto Gida district to the east are the districts that border Sasiga district. This area receives an average of 800 to 1500 millimeters of precipitation per year, and its elevation lies between 1200 and 1500 meters above sea level. Sasiga district experiences an average yearly temperature between 26.5 and 27 °C. There are a total of 32 kebeles in the Sasiga district (27 rural and 5 towns), together with 28 farmers' service cooperatives and 980.70 km2 of land. Within the district, there are around 12% arable land, 2% forested land, 3% forested land, and 84% grassland land.

Located in the East Wollega zone, Uke town is part of the Guto Gida district. It is 30 kilometers north of Nekemte City where the town is situated. Located in the heart of East Wollega Zone, the 901.80 km2 Guto Gida district is home to seven urban kebeles and twenty-one agricultural groups. To the north, the district is bordered by Gidda Ayyana, Abe Dongoro, and Gudaya Bila; to the east, by Sibu Sire and Wayyu Tuka; to the south, by Leka Dulecha; to the west, by Digga and Sasiga; and, finally, by Benishangul Gumuz Regional State. Uke town is located between 1,350 and 2,450 meters above sea level. A small portion (0.26%), a larger portion

(46.7%), and a larger portion (53%), constitute the district's three agro-ecological zones. The average yearly temperature in Uke town and the surrounding areas is little over 15°C, while the average annual rainfall is between 1,600 mm and 2,000 mm (GGDFEDO, 2011).

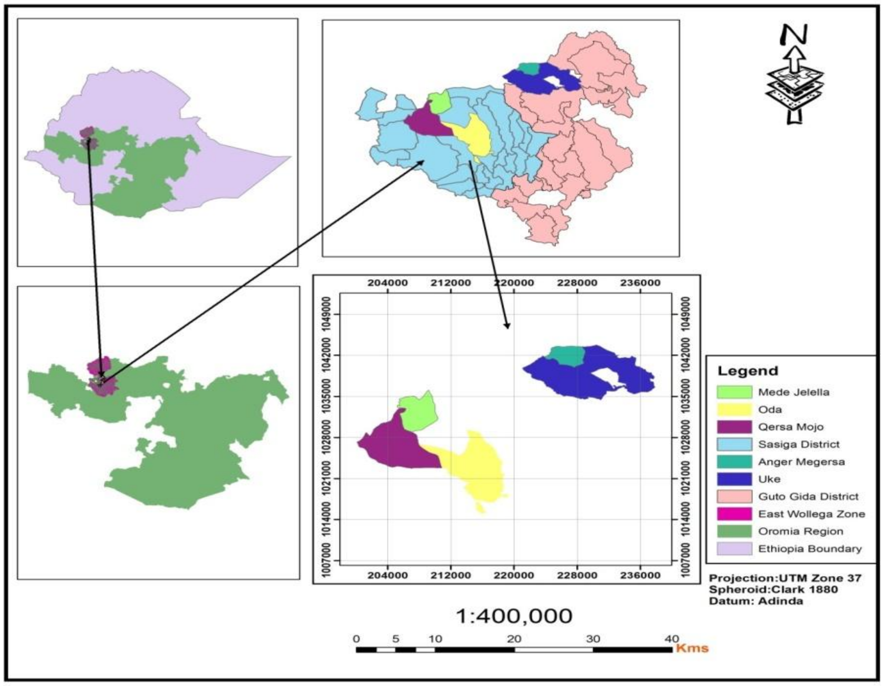

Figure 1. *Description map of study areas*

Sampling and data collection procedures

The two districts were chosen intentionally because of their respective fattening experiences in beef production. Based on the accessibility and availability of livestock fatteners, five PAs were identified from the two districts: Sasiga (three) and Guto Gida (two). The number of samples was decided using the formula proposed by Yamane (1967).

$$n = \frac{N}{1 + N\,(e^2)}$$

Where, n is sample size, N is the total households in the study area, and *e* is the level of precision

A semi-structured questionnaire and focus group talks were used to obtain data on feed resource availability and use at study sites. Secondary data from district agricultural offices supplemented primary data. Two phases were used in this study. A questionnaire survey with targeted respondents and a focus group discussion with traditional cattle fatteners on local feed resources in the research areas established the key feed resources used for cattle fattening in phase one. The second step of the investigation assessed feed nutrients.

Crop residues dry matter yield (DMY) estimation

The grain-straw ratio calculated crop residue DMY (FAO, 1987). The crops planted and the fraction of land area dedicated to the leading crops determines agricultural residue availability for animal feed. The harvest index (grain-to-vegetative matter ratio) on a dry matter basis estimated residual production. Thus, grain yield indirectly measures crop vegetative DM yield. The grain straw ratio of teff and finger millet was 1.5 tons/ha, while maize and sorghum stover yield estimations were 2 ns/ha and 2.5 tons/ha. Adugna and Said (1994) estimate crop residues for animal consumption assuming 10% waste.

Estimation of Native Pasture Yield

The biomass yields of communal and private grazing pastures were determined by tossing a 1 m x 1 m quadrant, harvesting, weighing, and drying the grass.

Estimation of the potential yield of browse trees and shrubs

Farmers' selection criteria were used to identify the most dominating and appetizing browse species, and measuring tapes were used to assess the potential biomass yield of these species based on the circumference of the trees and bushes that were chosen. The present investigation made use of nine different types of browse, with five plants representative of each species. The trees' diameters were determined by plugging their respective plant diameters (D) into the formula D=0.636C. Utilizing the technique devised by Pet Mark (1983), the potential yield of every browsing plant was determined.

$\log W = 2.24 \log DT - 1.5$ for trees

$\log W = 2.24 \log DS - 1.5$ for shrubs

Where, DT=diameter of trunk (cm) at 1.2 meter height (for tree leaf biomass);DS = diameter of stem (cm) at 30 cm height (for shrub leaf biomass)

Estimation of stocking rate

A plot of land's stocking rate is the total number of animals kept there for a specific time frame. Animal units per unit of land area are a common way to express stocking rate. Before estimating the stocking rate, it was necessary to catalog and quantify all herbivores in the region. Ten (10) calves per class were collected from the Sasiga district and the Uke area to determine the average mean body weight. The weight of the herbivores was determined by multiplying the estimated numbers of herbivores by their average weight. Then, the total weight of the herbivores was divided by 250 kg, which is equal to one tropical livestock unit (TLU) (Jemimah et al., 2011). Stocking rates were determined by dividing the total TLU of each research area by the sum of all grazing grounds in each district, whether private or communal. An animal's approximate weight was determined by measuring its heart girth. As shown below, the stocking rate was finally determined by dividing the total TLUs of the herbivores available in the areas by the total grazing land.

$$\text{Stocking Rate} = \frac{Total\ TLU}{Available\ grazing\ land\ area\ (ha)}$$

First, the amount of accessible feed resources were calculated; second, the number of forage species consumed by certain animals or groups of animals in the area was quantified; and third, the areas' primary feed resources that support herbivores were identified. Compared to the traditional method, the Average Animal Weight (AAW) approach provides more accurate results for determining the primary feed resources used by animals in tropical nations. Based on the metabolic rate requirements of a cow with calf, the average animal weight approach employs 0.02667 as the single conversion factor. All animals' feed needs, regardless of breed or species, were calculated once the area's total production was computed. This included the total "available" forages. In addition, taking into account the sizes of the available animals, the daily and monthly fodder requirements were determined using a conversion factor of 2.667%. Lastly, the feed resources needed to sustain the areas' primary herbivores were determined by multiplying the animal population by their monthly feed needs.

Sample processing procedures

We collected, pressed, labeled, stored, and transported samples of edible biomass from browse species (leaves and twigs) and natural pasture from grazing regions to the department of biology at Wollega University's main campus for chemical analysis. Consequently, DM, CF, ash, and ether extract were examined in accordance with AOAC (2000).

Analysis of Chemical Composition

According to the standard procedures outlined by Van et al. (1991), feeds can be categorized according to their proximate composition: moisture content, dry matter (DM), organic matter (OM), ash, crude protein (CP), neutral detergent fiber (NDF), acid detergent fiber (ADF), and acid detergent lignin (ADL). To find the DM and ash contents, we used the methods outlined by AOAC (1990).

Statistical analysis

The statistical method for the social sciences (SPSS) software version 21, with a significance level of $\alpha = 0.05$, was used to analyze the estimated biomass yield, feed utilisation, and chemical composition.

RESULTS AND DISCUSSION

Results

Socio-economic profile

In the regions under consideration, the predominant mode of production is a mixed crop-livestock system. Almost everyone who took the survey makes a living from raising cattle or growing crops, suggesting that agriculture is the backbone of the local economy. Approximately 83.3% of the participants were men and 16.7% were females in this study. About 25.3% of the people who took the survey can read and write; 32.7% went to elementary school, 16.0% went to secondary school, and 0.7% went to junior high. Participants who were mainly or secondary school dropouts were those who were actively involved in agriculture during the current study, despite the fact that education is a key factor in transmitting technology to farmers and initiating their readiness to embrace technologies. Married people made up the whole sample. There are both beneficial and bad impacts of family size on economic growth. On average, there were 5.6 ± 2.10 people living in the study areas per family. The labor-intensive nature of farming meant that families could have more children.

Respondents indicated that as family sizes grow, land holdings per person decrease. The historical context explains this phenomenon by showing how parents were compelled to part with or divide their property with their children upon marriage so that they might establish a permanent residence for their offspring.

Reasons for raising cattle

Over half of the farmers surveyed in the study regions raise cattle for meat, milk, and other economic purposes. For both financial gain and domestic use, nearly half of those who took the survey keep cattle. Cattle are not only the primary means of subsistence, but also a source of money due to their many byproducts: milk, meat, skin, and hides. Respondents disclosed that oxen are utilized for grazing land throughout cropping season and subsequently for fattening once cropping season ends. However, tiny ruminants are mostly kept for domestic food (56.1% of the population), as a source of revenue, and as a sacred animal for religious celebrations.

Homeowners' land holdings and usage habits

A look at Table 1 reveals the typical landholding of each household in the research region. On average, each household possessed 3.47±0.55 hectares of land, with a range of 0 to 7.13 hectares. A little over one-seventh of the households surveyed do not own any land at all; instead, they raise animals on shared pastures and on excess agricultural produce. People without access to their own property often rely on shared pastures for their livestock and enter into time-limited agreements with their neighbors to purchase plots of land on which to grow crops. There is a misconception in integrating crop and animal systems, since respondents claim that household land holdings have been falling periodically (Admasu, 2008).

In the Sasiga district, the average landholding per household was 3.19±0.55 hectares, whereas in Uke and its surrounds, it was slightly higher at 3.74±0.78 hectares. The average landholding recorded in this survey is more than the national average of 0.96 hectares per household and the Oromia region average of 1.15 hectares per household (CSA, 2018). The average area allotted for agricultural production was approximately 2.3±1.68 hectares, as reported by the participants. In contrast, around 0.42 ± 0.46 hectares of land were set aside for grazing. It is evident from this that around 66.3% of the land in the area is utilized for crop production, while 12.1% is used for grazing. Because of this, crop leftovers, particularly Uke, become the primary feed supply in the research region.

Table 1

Average land holding per household (ha) in the study areas

Type of land use	Land holding/household (ha)		Overall mean land holding/household (ha)
	Uke and its surrounding areas	Sasiga district	
Crop land	2.70±1.89	1.89±1.47	2.30±1.68
Grazing land	0.46±0.54	0.37±0.38	0.42±0.46
Fallow land	0.43±0.48	0.52±0.66	0.48±0.57
Forest land	0.15±0.21	0.28±0.19	0.22±0.20
Irrigation	-	0.13±0.06	0.13±0.06
Mean landholding/ha/HH‡	3.74±0.78	3.19±0.55	3.47±0.55
Average family size	5.10±1.69	5.29±2.07	5.20±1.88

‡HH=household

Up until 1991, state farms in the Sasiga district grew maize and sorghum in some locations. People from the Hararghe zones, in the eastern portion of Oromia, lived on most of the state-held farmlands after 1991, and some of those farmlands were owned by workers of the then-state farms. In addition, irrigated land was built by NGOs and distributed to homes in the area, with each household supposedly owning approximately 0.13 hectares. The Catha edulis tree, a stimulant bush plant, covered the majority of the irrigated lands throughout the current investigation. Planting sweet potatoes between the rows of chat trees gives the owners of the irrigated area a double benefit during the dry season. When it's dry, they utilize the sweet potato's leaves as green feed, and people eat the root.

The current survey found that on average, households had 10.2, 2.5, 3.3, 0.7, 6.3, and 1.8 cattle, sheep, goats, donkeys, beehives, and chicks, respectively. Every home has its own unique assortment of cattle, both in terms of variety and quantity. Over 60% of people who took the survey said they wouldn't want to increase their herd size due to the periodic decline in available grazing pasture. The amount of one's holdings is correlated with the number of livestock, according to respondents. Livestock numbers were disproportionately high among households with expansive plots of land. Except for those without access to property, who raised a few animals on shared pastures, respondents with smaller plots of land had fewer cattle.

Primary feed sources in the research regions

In the regions under consideration, natural pasture, agricultural leftovers, and crop aftermaths constitute the bulk of the feed resources. The most important feed resources in the Uke areas were communal grazing land, private grazing land, and crop leftovers, in that order; in the Sasiga district, the most important feed sources were private grazing land and crop residues, in that order. Communal and private grazing grounds are both present in the two research regions. Compared to farmers in the Uke areas, smallholders in Sasiga district are more likely to fence in their private grazing property. While nearly all responders in Sasiga district fence in their individual grazing areas, just under half of those in the Uke area do the same. Cattle graze crop remnants on riverbanks, bottomlands, and roadsides during the dry season. Green forages are nearly always accessible along the several perennial rivers that run across both research regions. Because most arable land is ploughed and covered with various crops throughout the rainy season, cattle also face feed problems, according to responses. Grown in the chat plant field, banana leaves, tree leaves, crop wastes, and other green feed (pasture) are gathered by producers. Consistent with the results of the present investigation

Livestock farmers in the research regions often keep crop leftovers, including sorghum and maize, in open, unprotected places. Nearly everyone in the Sasiga district who took the survey said they save hay for when the weather gets dry. Hay is made by gathering grass from producers' own grazing areas, as well as from the sides of roadways and crop fields. Grass from church grounds and public buildings like schools is also sold by some of the responders. In the study locations, other unconventional feeds were also utilized, such as banana and chat leaves, sweet potato vine, and cucumber (fruit). About 15% of feed resources in the Uke area and 24.4% in the Sasiga district are non-conventional feed. So that the animals wouldn't have any trouble ingesting it, producers would chop cucumber fruit before giving it to the animals. The summer and dry seasons also saw the utilization of sweet potato leaves as supplemental nutrition.

In the regions under investigation, improved forage is not routinely employed. Compared to the rainy season, the dry season saw a greater utilization of enhanced fodder. For instance, when it's dry season, they feed their animals pigeon pea, mulberry, and elephant grass. Natural pasture is the primary source of feed during the rainy season, while crop leftovers and stored hay are the mainstays of the dry season.

Comparison of the Biomass Yield of Various

Browse Feed Materials

Table 2 displays the various browse feed resources along with their anticipated biomass production. Researchers in this investigation were able to identify around nine distinct species of browsing trees. While the fruit of the Lilu plant is edible, all of the other plants that have been classified as browsing are only edible in their leaves. The plants that were sampled for their browsing productivity were as follows: the Lilu fruit tree, "Gambelo" (the native name), and pigeon pea, in that order. With 25 samples taken from each of the 225 plant species, we can estimate a total of 2.56 metric tons of DM production. With a yield that falls short of enhanced forages like elephant grasses (ranging from 4.87 to 18.4 tons per hectare), their accessibility is crucial for providing green fodder during dry seasons, when the quality of most feed supplies is declining. Animals that subsist solely on low-quality straws would benefit greatly from the increased protein content provided by these green fodders derived from browsing trees. However, compared to multipurpose fodder trees like Lucaenia leucocephala (0.185 ton/plant), the productivity of these native browsing species was significantly higher. Two key ways are impacted by the tree species on fodder productivity, according to respondents. The first is that they are naturally different in the amount of herbage that they can bear. Secondly, ruminants attack plants at different heights, which is a result of their distinct morphology. Herbage biomass productivity varied among these browsing plants for a variety of reasons, including but not limited to tree species and the fertility of the soil in which they were cultivated. Reason being, soil fertility might have varied among the nine browse plants, and they weren't all gathered from the same farm. Different types of soil have a direct impact on which plant species thrive and survive, according to some studies. Soil mineral nutrient combinations and concentrations are crucial to plant development and growth (Morgan et al., 2013). Herbage productivity in trees can also be influenced by the general ways in which those plants interact with their surroundings. Additional research has shown that plants are vulnerable to environmental changes, such as shifts in nutrient availability, which can cause severe harm (Morgan et al., 2013). However, human activities such as pruning trees for fences and other utility uses can also affect the herbage biomass production of plants.

Table 2

Estimated biomass yield of browse trees in the study areas

Browse species	Edible part	ATD	TC	EDM (kg/plant)	EDM*NMP (kg)	TEDM (kg)	TEDMt
Lucenia	Leaf	25.44	40	7.40	37	185	0.185
Sesbania	Leaf	20.35	32	5.622	28.11	140.55	0.14055
Pigeon pea	Leaf	7.63	12	1.170	5.85	29.25	0.02925
Mulberry	Leaf	20.35	32	5.522	27.61	138.05	0.13805
V. amygdelina	Leaf	22.26	35	6.29	31.45	157.25	0.15725
Lilu	fruit	127.2	200	43.02	215.1	1075.5	1.0755
Gambelo	Leaf	61.05	96	19.867	99.335	496.675	0.496675
Bamboo	Leaf	36.88	58	1.408	7.04k	176kg	0.176
Olia Africana	Leaf	22.89	36	6.511	32.55	162.75	0.16275
Total					467.045kg	2558.025kg	2.558025ton

ATD = Average trunk diameter; TC=Trunk circumference (cm); EDM = Estimated dry matter; EDM*NMP= estimated dry matter kg/plant * number of measured plant species; TEDM = Total estimated dry matter of all plant species in kg; TEDMt = Estimated total DM in ton

Crop Waste Biomass Yield in the Sasiga and Uke Districts

Table 3 shows the main crop residues that were accessible and utilized as feed resources, together with their estimated dry matter yields, in the research locations. However, teff covers approximately 78 hectares in Sasiga district. In the Uke area, the estimated total DM yield of all recognized crop residues as feed sources is 12,069 tons, while in the Sasiga district, it is 1 ton/ha. Reason being, compared to other crop species, maize and sorghum stover had the highest biomass production, and Uke areas produce more of these crops than Sasiga districts. In the Uke area, teff did not cover any ground. According to this survey, among the most prevalent crop residues in Sasiga district are sorghum stover and maize, while the least common ones are groundnut stubble and teff straw. The hot climate in the Uke area likely contributed to the lack of teff residues that were produced and used there. Maize stover yielded the driest matter (DM), whereas sorghum stover came in second. According to the data, teff straw had the lowest DM content. A competing interest in fuel poses the greatest threat to the utilization of sorghum and maize leftovers as feed. In a similar vein, teff residue finds utility in building. Although groundnut stubble ranks third in output amount (behind only maize and sorghum stovers), it serves solely as animal feed and has no competing interest. During dry seasons, when other green herbs are not accessible for animals to eat, the complete crop residues listed was available. As a result, the majority of ruminants have no choice but to eat low-quality roughages, such as straws, which may stunt their development or reduce the milk production of their mothers. In addition, animals have difficulty chewing the thick-stemmed stovers of sorghum and maize, which causes them to consume less grain. As a result, treating straw is a good way to increase the digestibility and consumption of animal feed. Chemical treatments, like using NaOH, NH_3, or urea, and biological treatments are more practicable for use on farms and improve the nutritional qualities of crop residues, according to researchers (Sarnklong et al., 2010). Similarly, Getahun (2014) found that supplementing with Leucaena leucocephala leaf and treating with urea boosted the consumption of wheat straw.

Table 3

Estimated dry matter (DM) yield of different crop residues

Type of residues	Uke area		Sasiga district		Overall cultivated area (ha)	Overall estimated DM (ton)
	Area cultivated (ha)	Estimated DM (ton)	Area cultivated (ha)	Estimated DM (ton)		
Maize stover	2759	6987.5	2214	5285	4973	12272.5
Sorghum stover	1806	4515	1535.5	3838.75	3341.5	8353.75
Finger millet	201	301	197	295.5	398	596.5
Teff straw	-	-	78	117	78	117
Groundnut stubble	530	265	715	357.5	1245	622.5
Total DM	5,296ha.	12,068.5ton	4,739.5ha.	9,893.75ton	1,003.5ha.	21,962.25ton

DM=dray matter yield; ha=hectare

Major Feed Resources in the Study Areas

Table 4 shows the total dry matter (DM) production of various feed resources in the Sasiga and Uke districts. From shared grazing land, the average yield of native pasture on a DM basis varies between 2.1 and 3 tons/ha in the research districts. In terms of total biomass yield, the public grazing land district achieved 3,223 tons, whereas the private grazing land district achieved 17,548 tons. Results showed that compared to community grazing area, enclosed private grazing pasture produced around four times as much feed. The rationale for this is that communal grazing land is not adequately managed, in contrast to privately owned grazing property. On the contrary, all smallholder households let their animals to graze freely, leading to increased damage to the grazing ground through competition. According to Berhanu et al. (2004), smallholder farmers may have taken collective action to address the negative effects of competitive grazing. Mengistu et al. (2013) and others have verified that communal grazing land can be better managed collectively, which helps with feed shortages and overgrazing-related land degradation.

In the Uke area, crop residues had the highest dry matter (DM) yield, followed by forage yields from private grazing property; however, in the Sasiga district, the opposite was true. The fact that the Uke area has the largest DM yield suggests that a lot of that land is dedicated to growing crops, whereas the Sasiga area has less land taken up by food crops. Goat farming could be a viable option in Sasiga due to the improved browse resource availability; after all, goats are typically browsers. The study areas' key feed resources, including private and public grazing grounds as well as crop leftovers, are projected to have a total DM output that is mostly dependent on improvement measures.

Table 4

Estimated DM yield (tons) of major feed resources per district and their rank

Major feed resources	Uke area	Rank	Sasiga District	Rank
Communal grass land	1,089	3	234	3
Private grazing land	1,860	2	15,648	1
Crop residues	12,068	1	9,893.75	2
Browse trees	1.023	4	1.535	4
Total DM (tons)	15,018.02		25,777.28	

DM=dry matter yield

Chemical Compositices in the Study Areas

Table 5 shows the chemical make-up of some dieton of Major Feed Resours that ruminants and horses often consume. The feeds that were examined included hay that had been preserved, forage that had been improved (such as Rhodes grass, Elephant grass, Brachiaria, and Desmodium), trees that were used as browse (such as Mulberry, Sesbania sesban, Leucaenea, Pigeon pea, Vernonia), lilu (fruit), Olia africana, bamboo, "Gambelo," and other materials that were readily available, such as cucumber and sweet potato leaves.

Groundnut straw, maze stover, sorghum stover, teff, and finger millet straws were among the crop remnants that were also examined. All of the feeds that were considered had DM contents between 93% and 96%. Pigeon pea, Gambelo, and sweet potato leaves had the lowest DM values, while most of the improved forages and others, such sorghum stover, bamboo, and finger millets, achieved the greatest. The ash content was found to be highest in maize stover, at 21.05% in the Uke area, and lowest in Olia africana and 'Lilu' fruit, at 3.19%. Due to the dusty condition in the lowland sections of the study sites, the maximum ash measured for maize stover could be linked to soil contact with the sample.

Table 5

Chemical compositions of the different feed materials evaluated at laboratory

Types of feed	Uke area						Sasiga district					
resources	DM%	Ash%	CP%	NDF%	ADF%	ADL%	DM%	Ash%	CP%	NDF%	ADF%	ADL%
Improved forages							95					
Rhodes grass	95	5.26	3.76	78.67	63.16	15.50	94	5.32	3.82	81.11	66.54	15.40
Elephant grass	95	8.42	7.91	66.50	52.63	12.35	94	6.38	9.30	65.46	51.06	12.40
Sudan grass	95	7.37	8.62	75.00	61.05	15.00	94	5.32	17.79	61.20	44.68	11.60
Brachiaria	95	7.37	3.37	74.35	58.95	13.30	-	-	-	-	-	-
Desmodium	95	6.47	14.91	58.70	40	10		-	-	-	-	-
Browse tree species										-		
Mulberry	-	-	-	-	-	-	95	7.45	23.46	31.08	17.02	4.42
Sesbania sesban	94	11.70	18.18	34	21.28	5.50	94	7.45	26.57	40	25.53	5.50
Leucenia	95	12.63	23.95	32.10	18.95	4.45	94	11.70	16.95	40	34.04	9.46
Pigeon pea	93	3.23	16.40	66.37	40.86	10	94	6.38	20.81	52.40	36.17	9.46
Vernonia	94	9.57	17.40	41.10	27.66	6.41	94	8.51	20.19	42.30	27.66	7.58
Lilu (fruit)	94	3.19	9.92	52.40	36.17	9.46	94	3.19	9.75	62.20	48.94	11.60
Olia Africana	94	3.19	10.37	71	53.19	12.73	94	3.19	11.44	53.28	38.30	9.46
Bamboo	96	9.37	16.30	60	47.92	11.40	95	9.47	16.01	72.20	54.74	12.35
Gambelo	93	8.60	7.40	40	27.96	6.41	94	10.64	7.81	52.40	36.17	9.46
Non-conventional feeds												
Cucumber	-	-	-	-	-	-	94	5.32	6.71	33.26	19.15	5.42
S. potato leaf	-	-	-	-	-	-	93	6.45	6.74	73.27	55.91	12.45
Crop residues												
Maize stover	94	21.05	2.50	72.18	53.19	12.40	94	22.34	3.01	62.20	48.94	11.60
Sorghum stover	95	4.21	4.60	77.30	61.05	14.15	96	6.25	3.44	78.56	62.50	14.36
Groundnut straw	94	5.32	8.49	71.34	55.32	13.26	94	6.38	10.60	61.07	44.68	10
Teff straw	-	-	-	-	-	-	94	7.45	6.22	65.46	51.06	12.40
F. millet straw	95	4.21	2.92	67.63	52.63	12.35	95	6.32	5.19	63	46.32	11.38

S. potato leaf = Sweat potato leaf; F. millet straw = Finger millet straw; CP= Crude protein

DISCUSSION

The chosen feeds had crude protein (CP) concentrations ranging from 2.5% to 26.6%. The crude protein content was found to be highest in Sesbania sesban and lowest in maize stover. All of the browsing plants, with the exception of "Gambelo," showed encouraging results in terms of CP content throughout both research locations. Grass species contributed an average of 7.7 percent of CP and browsing plants 14.9 percent in the research regions. Grass species had the greatest fiber contents, including acid detergent fiber (ADF), neutral detergent fiber (NDF), and acid detergent lignin (ADL), whereas browse species had low to medium values.

Under specific circumstances, NDF has been suggested as a trustworthy indicator of voluntary consumption of dry matter (DM) (Minson, 1990). Animals' DM intake dropped significantly (22.2%–45.8%) as NDF concentration rose (Arelovich et al., 2008).

The present investigation found that grasses made up a large portion of NDF, suggesting that this feed was not consumed to its full potential. Additionally, digestibility is mostly dictated by ADF, the principal chemical component of meals; ADF is a measure of cell wall composition. The results show that feed digestion rates are inversely related to ADF content (McDonald et al., 1998). Because it had the lowest ADF percentage (32.10%), among all the browsing plant species studied as feed resources, Leucenia had the greatest digestibility estimate in this study. It appears that this grass has poor feed intake, digestibility, and overall animal performance since its fiber compositions (NDF%, ADF%, and ADL %) are higher than those of the browsing feed resources.

CONCLUSIONS

Natural pasture and agricultural leftovers were the primary feed sources for cattle in the Sasiga district and the Uke area. Compared to the town areas of Uke, Sasiga district had larger private grazing land. The availability of community grazing land is higher in the Uke area than in the Sasiga district. The most common types of crop leftovers include sorghum and maize stover, groundnut straws, teff straws, finger millets, and more. Uke town and the surrounding area saw more production and use of crop leftovers than Sasiga district. Most crop leftovers and pasture resources require feed treatment interventions to improve their low crude protein and high fiber contents. Researching the anti-nutritional component composition of native shrubs and trees used for browsing, with a focus on condensed tannin, is crucial. Generally speaking, farmers in the study areas need capacity training in order to properly manage the feed supplies that are available to them.

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DECLARATION

The authors declare that they have no known competing financial interest or personal relationships that could have appeared to influence the work reported in this paper.

DATA AVAILABILITY

Data will be made available on request.

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