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Assessment of Livestock Production Situation, Feed Resources and Utilization of Feeds from Cropping Systems and Forages in Southern Ethiopia

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ABSTRACT

A study was conducted in Loka Abaya and Amaro districts of Southern Nations Nationalities and Peoples Region Southern Ethiopia to assess livestock production situation, feed resource availability, utilization of forages and feeds derived from cropping systems focusing on cassava and pigeon pea foliage by smallholder farmers. Three rural kebeles from Loca Abaya and four from Amaro districts were purposely selected. A total of 150 households were interviewed using semi-structured questionnaires and focus group discussion were held. The descriptive statistics result indicates that the main livelihood activities of 75% of respondents were crop and livestock production. The mean grazing landholding per household was 0.29 ± 0.2. Of the interviewed farmers 78.6% kept cattle primarily for traction and 84.2% reared small ruminants as a source of immediate cash income. The Perennial landholding size, cattle, goat, poultry and beehive per household was higher ($p<0.05$) in Amaro district compared with Loca Abaya. In the dry season (October to February) feed shortage and water scarcity were the main livestock production constraints, thus crop residues were the main source of livestock feed. Horticultural crops fractions, root crops, trees and bushes leaves were used as supplement feed to mitigate scarcity of feed by 78% of farmers. Cassava (*Manihot esculenta crantz*) foliage was utilized as dry season supplement by 69.3% farmers in Amaro district. Pigeon pea (*Cajanus cajan*) foliage was utilized by 29.3 and 40% of the livestock holders in Loka Abaya and Amaro districts, respectively. Therefore, to sustain livestock productivity in the districts improving feed value of crop residues, cultivating dual-purpose, drought-tolerant crops and utilization of foliage as feed scarcity mitigation is important.

Keywords: Cassava, Foliage, Feed utilization, Production constraint, Pigeon pea and Seasonal variation
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INTRODUCTION

Ethiopia is endowed with a large livestock population (CSA, 2014/2015). However, the productivity and economic contribution of the livestock sector is much below the potential due to several constraints of which inadequate feed supply and inefficient feed management and utilization play a major role (Adugna et al., 2012). Feed scarcity and quality deterioration during the dry season are the main challenges facing smallholder farmers in Southern Ethiopia (Takele and Habtamu, 2009). In mixed crop-livestock farming system natural pasture and crop residues make the main source of livestock feed (Adugna et al., 2012). Continuous grazing is practiced on communal and private grazing land, fallow land and cropland after harvest. However, crop residues are gaining more importance as sources of livestock feed, especially during the dry season. The contribution of agro-industrial by-products is minimal and restricted to some urban and peri-urban dairy, poultry and cattle fattening farms (Alemayehu, 2006). According to Yeshitila et al. (2009) in densely populated areas like Alaba district of southern Ethiopia, where the proportions of grazing land is highly diminishing and crop cultivation is taking over grazing lands, most of the livestock feed is obtained from crop residues. Cassava is one of the suitable crops cultivated for human food in densely

populated and lowland areas.
It was introduced to drought-prone areas of southern Ethiopia such as Amaro, Gamogoffa, Sidama, Wolayta and Gedeo to mitigate the effect of drought (Feleke, 1997). According to Lukuyu et al. (2014) all parts of the cassava plant are readily utilized in feeding of small ruminants. Other types of dry season feed resources available in lowland areas include leaves of indigenous trees and shrubs (Adugna, 2008). Tree legumes have important roles including serving as source of feed for animals and maintenance or improvement of soil fertility for improved crop production in many agricultural production systems throughout the world (Gutteridge and Shelton, 1998). Moreover, the use of dual-purpose forage legumes such as pigeon pea and cowpea could play an important role in alleviating animal feed and human food shortages in densely populated areas. Pigeon pea seeds are used for food while the leaves/twigs are used as feed for livestock (Ajebu et al., 2013). Thus, this study was conducted to assess opportunities and challenges of livestock production, to assess feed resources availability, especially cassava and pigeon pea foliage utilization by smallholder farmers.

MATERIALS AND METHODS

Description of The Study Sites

The study was carried out in Loka Abaya and Amaro districts of Southern Nations Nationalities and Peoples Regional State. Loka Abaya is found in Sidama Zone and represents moist *Kola* agro-ecology with altitude ranging from 1170 up to 1500 meters above sea level (m.a.s.l.) (IPMS, 2005). The annual minimum and maximum temperatures are 17 and 20°C.
The annual rainfall is about 900 to 1400mm (Bewket et al., 2015). Amaro district is located at an altitude ranging from 1420 to 1610 meters above sea level (m.a.s.l). Average annual rainfall amount ranges from 801mm to 1000 mm. The mean minimum and maximum temperature are 12 and 25°C (AWADO, 2010).

Sampling Design and Data Collection Procedure

Based on the livestock population size obtained from the Agriculture office and accessibility for the survey work three and four representative kebeles were purposefully selected from Loca Abaya and Amaro districts, respectively. Households were randomly selected from each kebele based on the total number of households. Then a total of 150 households were interviewed for the study. Primary data on land holding, livestock holding and herd structure, major livestock production constraints, feed resources, availability and utilization of cassava and pigeon pea foliage were collected using structured and semi-structured questionnaires. Focus group discussions were conducted at each Kebele with male and female farmers of different age groups using ILRI (2015) Feed Assessment Tool focus group discussion guide. In addition, key informant interviews were made with livestock, forage and veterinary experts in each district. The discussions identified major livestock production constraints and availability of livestock feed resources in dry and rainy seasons and used as a means of verification for the information collected from individual household survey.

Data Analysis

Data generated from the survey were analyzed using the statistical procedure for social science (SPSS), version 20 (2016). Descriptive statistics were used to describe qualitative and quantitative data. T-test was used to observe variation between the two districts with regard to land holding, grazing landholding, livestock population, herd composition, and local cow performance.

RESULTS AND DISCUSSION

Agricultural Activities and Source of Income

Most (78.6%) of the farmers reported that both crop cultivation and livestock production were their major agricultural activities (Table 1). Livestock production was equally important with crop production. Loca Abaya and Amaro districts are under subsistence crop-livestock production system. Consistent with this result, Zemach and Endrias (2015) reported that in Amaro district most (70%) of the farmers were engaged in mixed crop-livestock production system. In addition, few respondents reported that they earned additional income from nonfarm activities such as salary obtained from guarding and petty trade. Thus, livestock and livestock products are an important source of income of the farmers. The current finding is in line with previous report of South Nation Nationalities People Regional State (SNNPRS) livelihood profile (2005) that depicted the farmers in Amaro district earning half of their income from livestock including fattened oxen and butter sales.

Average Holding And Land Use Pattern

The average landholding per household (HH) and average grazing land per HH of Loka Abaya and Amaro districts are not significantly different (Table 2). The average landholding (1.49 ± 0.10) of this study area was lower than the value (3.6 ha per HH) reported for Burgi district (Seid and Birhan, 2014).
Perennial cropland holding per HH was higher ($P < 0.05$) in Amaro district compared with Loka Abaya. The main annual crops cultivated were maize, teff and haricot bean.

Table 1. Agricultural activities and sources of income by the respondent farmers.

	Districts					
	Loka Abaya		Amaro		Over all	
	n	Percentage	n	Percentage	n	Percentage
Activities 10 years before						
Crop production alone	12	18.5	20	23.5	32	21.3
Crop and livestock production	53	81.5	65	76.4	118	78.6
Activities in 2015						
Crop production alone	13	20.0	25	29.4	38	25.3
Crop and livestock production	52	80.0	60	70.5	112	74.6
Source of income						
Crop sale only	26	40.0	30	35.2	56	37.3
Animal sales only	12	18.5	10	11.8	22	14.7
Crop and animals' sale	28	43.0	27	31.8	55	64.7
Sale crops and animal products	26	40.0	13	15.3	39	45.8
Nonfarm activities	10	15.3	9	10.6	19	12.7

Source: Own survey result (2015).

Table 2. Average holding (ha) and land use pattern (mean ±SE).

	Districts		
Variables	Loka Abaya	Amaro	Over all
Land holding	1.37 ±0.11	1.6±0.16	1.49 ±0.10
Annual crop land	0.86±0.10	0.77±0.12	0.8±0.08
Perennial crop land	0.34 ± 0.03[b]	0.70 ± 0.08[a]	0.53±0.56
Grazing land	0.26 ± 0.04	0.35 ±0.08	0.29 ±0.28
Other land	0.27 ± 0.08	0.38 ± 0.12	0.32 0.33

Source: Own survey result (2015). Means within the same row with different superscript letters are significantly different (P<0.05). Other land represents the land occupied by house and homestead.

Haricot bean is mostly intercropped with maize. Farmers sow maize followed by haricot bean. Teff is sown during the major rainy season, usually in July. The perennial crops dominantly found were Enset, Banana, Sugar cane, and root crops. The small landholding per household is a typical feature of the mixed crop-livestock production systems in the densely populated mid-latitude and highland areas of Ethiopia. Lack of grazing land by most farmers in Loka Abaya is in agreement with the report of Adugna (2008) on his report on Sodo Zuria district. A larger proportion of land is used for annual crops (maize, teff and haricot bean) than the land occupied by perennial crops. These crops are early maturing, particularly maize is the primary crop in the study area that is cultivated by all farmers.

Livestock Holding and Cattle Herd Composition

The number of calves, bulls, cows, goats, poultry and beehives were higher (P<0.05) in Amaro than Loka Abaya (Table 3). Cattle are the dominant livestock in the study area followed by goat and sheep. The cattle herd is largely composed of cows followed by calves, and oxen. Nearly all of the respondents reported that they reared cattle. The cattle available in the area are mainly indigenous breed. Those who reported not keeping cattle were mainly due to shortage of grazing land and lack of initial capital to purchase cattle. The respondents also indicated that they had one donkey per household on average which played significant roles as a means of transport. Poultry production was important for smallholder farmers as source of food and income. In line with this study Tadelle and Ogle (2001) expressed that rural poultry production is one of the most appropriate income-generating activities for rural women and landless and marginal farmers in Ethiopia.

Importance of Livestock Production

Most (78.6%) of the farmers were keeping cattle for draught power. About 61.3% of the households keep livestock as a source of income from the sale of live animals and animal products (Table 4). They reported that cattle are the most important livestock species as a source of food. After being used for plowing for certain number of years, the oxen are conditioned and sold to generate income. Cattle were the most important livestock for their day to day activities as draught animal, food and income source and their manure are also used as fuel and fertilizer. This result is in agreement with previous researches in southern Ethiopia by Adugna and Aster (2007), Osterle et al.

Table 3. Livestock holding and cattle herd composition per household (mean ±SE) in number.

Livestock Type	Districts		
	Loka Abaya	Amaro	Over all
Cattle	6 ± 0.60[b]	10 ± 0.82[a]	8 ± 0.53
Calf	1.9±0.23[b]	2.79±0.33[a]	2.5± 0.20
Heifer	1.78±1.47	2.83±1.40	2.01±0.15
Bull	1.71±0.18[b]	2.35±1.23[a]	2.2±0.13
Oxen	1.67±0.15	2.76±0.71	2.23±0.37
Cow	2.52±0.27[b]	3.75±0.48[a]	3.2±0.26
Goat	4 ±0.42[b]	7 ±0.73[a]	5±0.46
Sheep	2±0.36	2±0.47	2±0.28
Donkey	1±0.11	1±0.11	1±0.09
Poultry	4±0.39[b]	6±0.54[a]	5±0.34
Beehives	6±1.53[b]	15±4.48[a]	10±2.14

Source: Own survey result (2015). Means within the same row with different superscript letters are significantly different (P<0.05).

Table 4. Purpose of keeping livestock as percentage of respondent farmers.

Livestock	Districts					
	Loka Abaya		Amaro		Over all	
	n	Percentage	n	Percentage	n	Percentage
Cattle						
Source of food	49	75.3	53	62.3	102	68.0
Source of power	45	69.2	73	85.9	118	78.6
Sell livestock products	21	32.3	18	27.7	39	26.0
Sell live animals	40	61.5	51	78.5	91	60.7
Sell live and their products	45	69.2	47	43.0	92	61.3
Small ruminants						
Source of meat	18	45.0	37	67.3	55	57.9
Source of milk	9	20	16	29	25	26.3
Sale live animals	33	73.3	47	85.5	80	84.2
Sale products	14	21.5	20	36.3	34	35.9

Source: Own survey result (2015).

Table 5. Production and reproduction performance of local cows (mean ± SE).

Parameters	Districts		
	Loka Abaya	Amaro	Over all
Age at 1st parturition (years)	4.21 ± 0.10	3.94±0.09	4.22 ± 0.07
Parturition interval (years)	2.16±0.71	2 ± 0.07	2.07±0.06
Milk yield, liter/day	1.28±0.05	1.14±0.67	1.21±0.05
Off springs born in life time (number)	7.35±0.18	7.65±0.17	7± 0.14
Lactation length (months)	6.77±0.44[a]	5.67±0.32[b]	6.03±0.30

Source: Own survey result (2015). Means within the same row with different superscript letters are significantly different (P<0.05).

(2012) and Seid and Birhan (2014). Small ruminants are used for sale to generate cash income and for production of meat and milk for home consumption. The milk produced by small ruminants particularly goats was very small and offered only to children. Similarly, Abegaze et al. (2018) reported that the purpose of keeping small ruminants in Esera district of Dawro Zone, Southern Ethiopia, was mainly for immediate income-earning and as insurance.

Production and Reproduction Performance of Cattle

Table 5 shows the production and reproduction performance of cattle in the study area. The average age at first parturition was four years with an average parturition interval of two years in both districts. The mean milk yield was reported to be about 1.2 liters/cow/day. The average length of the lactation period was 6 months and cows produce an average of

Table 6. Livestock production constraints by season of the study districts (priority level).

	District													
	Loka Abaya							Amaro						
Constraints	**1**	**2**	**3**	**4**	**5**	**Index**	**Rank**	**1**	**2**	**3**	**4**	**5**	**Index**	**Rank**
Short rainy season														
Feed shortage	10	76	2	2	0	0.25	2nd	4	15	4	0	0	0.23	2nd
Water scarcity	0	54	4	2	0	0.16	4th	0	20	2	0	0	0.21	3rd
Shortage of capital	5	60	4	3	1	0.11	5th	2	14	2	2	0	0.20	4th
Lack of market	0	58	3	2	1	0.17	3rd	2	12	2	0	0	0.16	5th
Disease	40	50	3	3	0	0.29	1st	11	12	3	2	0	0.29	1st
Main rainy season														
Feed shortage	2	1	6	2	0	0.09	4th	0	0	15	1	0	0.11	4th
Water scarcity	1	5	2	0	0	0.08	5th	0	0	10	2	2	0.08	5th
Shortage of capital	10	5	3	0	0	0.21	3rd	20	0	2	2	0	0.25	2nd
Lack of market	18	5	3	1	1	0.33	1st	10	1	2	2	0	0.24	3rd
Disease	14	5	3	0	0	0.27	2nd	23	3	2	2	0	0.31	1st
Dry season														
Feed shortage	51	1	4	0	0	0.37	1st	26	6	3	2	0	0.31	1st
Water scarcity	48	0	2	0	0	0.33	2nd	24	5	2	0	0	0.30	2nd
Shortage of capital	3	1	16	3	0	0.09	4th	0	2	15	1	0	0.09	5th
Lack of market	1	12	2	0	0	0.08	5th	2	2	10	2	1	0.10	4th
Disease	4	1	20	1	2	0.12	3rd	4	1	19	2	2	0.17	3rd

Source: Own survey result (2015). Index = the sum of (5 times first order + 4 times second order +3 times third order + 2 times fourth order + 1 times fifth order) for individual variables divided by the sum of (5 times first order + 4 times second order +3 times third order + 2 times fourth order + 1 times fifth order) for all variables.

seven offspring in their lifetime. Production performances of local cows were low with lower milk yield and shorter lactation length. The average milk yield per cow in this study was below that reported by Abera et al. (2018) in Loka Abaya district. The lactation length was lower than the result reported by the same author. Longer age at first parturition and shorter calving interval (less than 2 years) were also reported by Abera et al. (2018).

The lactation length was reported to be shorter ($P<0.05$) in Amaro district compared with Loka Abaya. This might be due to larger number of cows in Amaro district and shortage of feed than in Loka Abaya. Adugna and Aster (2007) reported that shortage of feed and water seriously affects production and reproduction performance of animals.

Livestock Production Constraints

In both districts feed shortage was reported to be the main constraint during the dry season (Table 6). Among the livestock production constraints feed shortage was reported to be the primary challenge due to lack of sufficient private and communal grazing land and expansion of crop production into grazing land. In addition, fencing off part of the communal grazing land as a park in Loka Abaya district contributed to the problem of feed shortage. Similarly, in Amaro district as well the grazing land in some kebele has been transferred to the neighboring district. The finding with respect to feed shortage is consistent with the national situation as reported by Adugna (2008) due to rapidly increasing human population and expansion of cropping into traditional grazing areas. Overall, feed shortage in both quality and quantity is a major constraint affecting animal production in the study areas which is compatible with previous reports by Adugna et al. (2012) and Shapiro et al. *(*2015). However, in Loka Abaya district Abera et al. (2018) identified that feed shortage is next to disease that hinders cattle production and reproduction. Water scarcity was the second constraint during dry season in both districts. In some kebeles of Loka Abaya district (Argeda Haro Dintu kebele) farmers traveled from 5 to 10 km to obtain water. Lack of permanent rivers and absence of natural or constructed ponds were the main factors for water scarcity. Thus, farmers required more labor to supply water to their livestock.

Disease problem was more prevalent during the main and short rainy seasons as compared to the dry season. At the beginning of short rainy season, the livestock is more exposed to bloat due to availability of herbaceous legumes and weeds. However, the respondents in Amaro district indicated that Trypanosomiasis is a common problem during the dry season as the animals become more susceptible due to scarcity of feed. Vaccination service was delivered for prevention of livestock disease in both districts as reported by most (80%) farmers. Thus, other diseases are not prevalent except bloating that commonly occurred in the rainy season.

Livestock Production Constraints; Coping Strategies

Majority of the farmers collecting and storing a smaller

Table 7. Livestock production constraints coping strategies (Percentage respondents).

	Districts					
	Loka Abaya		Amaro		Over all	
Mitigation Practice	**n**	**Percentage**	**n**	**Percentage**	**n**	**Percentage**
Feed shortage mitigation						
Feed conservation (crop residues)	53	81.5	59	69.4	112	74.6
Horticultural crops fraction and tree leaves	49	75.3	68	80.0	117	78.0
Purchased feed	23	35.3	13	15.3	36	24
Move to Abaya Zuria	7	10.3	-	-	-	-
Sale livestock	4	6.1	11	15.3	15	10.0
Water scarcity reduction						
Used constructed pond and well	7	10.7	40	47.0	47	31.3
Fetch water from far area	37	56.9	43	50.6	80	53.3
Search water from sand and pond	-	-	11	12.9	-	-
Disease prevention						
Properly feed	20	30.7	27	31.7	47	31.3
Vaccination	49	75.4	71	83.5	120	80.0

Source: Own survey result (2015).

proportion of grass hay and larger proportion of crop residues (Table 7). Cereal crop residues such as maize stover, teff straw and haricot bean haulm are the main livestock feed in the dry season. This is in line with Osterle et al. (2012) who indicated that crop residues seemed to be the main feed resource, as no or few additional concentrates were given to animals in the lowlands and mid-altitude of Southern Ethiopia. The farmers do not use urea treatment for improvement of the feeding value of crop residues although development agents and district level livestock experts claimed that they have provided such training to the farmers. Some farmers indicated that they chop the straw before feeding to minimize wastage and to enhance utilization. However, Abebe et al. (2014) reported that the effort made to improve the utilization of crop residues was not practiced in Ezha district of Gurage Zone, Southern Ethiopia. Some farmers who live near main roads purchased grass hay, crop residues mainly teff straw and agro-industrial by-products to some extent. Agro-industrial by-products are used to feed milking cows and draught oxen.

The high cost of purchased feeds such as agro-industrial by-products concentrate mixtures and salt is the main deterrent from the use of purchased feed in the study areas. Therefore, farmers use any available green forages to supplement animals. Supplementation with enset, banana, sugar cane and root crops in fresh form is the other important feeding practice. Chopped enset, banana leaves and stem are fed to livestock, thus highly valued as supplementary feeds in the dry season as they also serve as sources of water for the animals. This is in agreement with Dereje (1996) who concluded that enset was utilized as feed and water source as well in Southern Ethiopia. Besides, Ajebu et al. (2007) emphasized that enset fractions; especially enset leaf could be an important source of feed, particularly during the dry season. Indigenous trees and shrub leaves are also offered to cattle and small ruminants as a means of dry season feed shortage mitigation. The result is consistent with Abebe et al. (2014) who indicated that the majority of the respondents use combinations of different feed resources based on availability in Southern Ethiopia. Smaller proportion of farmers in Loka Abaya district temporarily moved their livestock in search of grazing land and water around Lake Abaya (Abaya Zuria kebele) during advanced dry season starting from the end of January until the beginning of the rainy season in March or April. Farmers fetched water from natural sources or from the constructed water supply. This is in line with Takele and Habtamu (2009) who reported that scarcity of water during the dry season is overcome by fetching water from distant areas.

Feeding System and Feed Resources Utilization

From the study grasses, edible forages, crop residues and agro-industrial by-products to a limited extent are the available feeds (Table 8). Grazing was the main source of feed for livestock during the main rainy season. Loka Abaya and Amaro districts are characterized by very small size of private grazing land (Table 2). Majority of the farmers in Loka Abaya tether their livestock around the homestead. In Amaro district, livestock grazed on communal grazing land in some kebele. Thus, mixture of grasses and all herbaceous ground layers: edible weeds that are found under perennial crops are cut and offered to livestock from the beginning of short rainy to the main rainy season. Crop residues serve as major sources of feed from the period of crop harvest in October onwards and until the end of the dry season in March. The results are in line with previous findings of Solomon et al. (2008) who showed that crop residues are the main (81.4%) source of livestock feed during the dry period from early January

Table 8. Feeding system and feed resources availability.

Feed resources	Months											
	Main rainy				Dry					Short rainy		
	June	July	August	September	October	November	December	January	February	March	April	May
Grazing												
After math grazing												
Cut and carry forage												
Crop residues												
Standing hay												
Maize thinning												
Horticultural crop fractions												
Trees and shrub leaves												
Agro industrial by products												

Source: Own survey result (2015).

to April in mixed crop-livestock production system. During the short rainy season grasses, weeds and crop thinning become available and serve as important source of feed. Most farmers offer different types of feeds to their animals and the feeds are sourced mainly from their own farm.

This finding is in line with CSA (2014/2015) which indicated that a large number of the livestock keepers in the SNNPRS of Ethiopia feed their animals from their own farm while only small proportion purchase feed from outside their farm. Farmer's landholding size and seasonal rainfall condition determined the availability of feeds in household level. However, the limited area of grazing land, in general, implies that grazing makes limited contribution to the livestock feed supply. This is consistent with the report of CSA (2013) that indicate the decline to (57%) the share of natural grazing pasture as livestock feed at the national level. The farmers offer salt (salt lick or table salt) to their animals only during the rainy season when green forage and sufficient water are available in the area. They believe that feeding salt during the dry season when there is shortage of water and green forage has negative effect on the health of the animals. The finding is consistent with the study of Dejene et al. (2014) in Borana zone who reported that the lowland farmers supply salt to their livestock mainly during the *Gana* (rainy) season. Temesgen et al. (2018) also indicated that farmers perception of feeding salt to animals during the dry season. When they do not get adequate feed and water supply could harm the animal; that is, they think that it could cause emaciation and may ultimately kill the animals.

Grass and Browse Species Availability

From this study, it was evident that in Loka Abaya and Amaro district, indigenous and improved grasses, edible weeds, indigenous trees and bushes available (Table 9). Despite the small size of private and communal grazing land, mixtures of forages are found in the study area. This shows the suitability of the area for growing different livestock forage. Natural pasture is dominated by mixture of indigenous grass species such as *Hyperhenia rufa and Eleusin floccifoli*. In Loka Abaya district, *Camelina africana* is the preferable weed by livestock as it stays green in the dry season under enset plant, Among the indigenous tree species *Vernonia amygdalina, Cordiaa fricana* and *Balanites aegyptiaca* are commonly found around the homestead. The availability of improved forage and pasture species in both districts is very much limited**,** like other rural districts of the region and the country. Poor extension service by the government and limited efforts of the farmers contributed to the condition. The result is consistent with the report by Adugna (2008) who indicated that only few farmers produce improved forage crops and fodder trees.

Cassava and Pigeon Pea Foliage Utilization

In Amaro district, cassava is cultivated for tuber

Table 9. Grass and browse species in the study district.

Districts	
Loka Abaya	**Amaro**
Grass and Weed Species	**Grass Species**
Hyperhenia rufa	*Eleusin floccifolia*
Cynodon dactylon	*Cencheris cilaris*
Pennisetum purpureum	*Pennisetum purpureum*
Pennisetum pedicellatum	
Camelina africana	
Browse species	**Browse species**
Vernonia amygdalina	*Vernonia amygdalina*
Cordia africana	*Cordia Africana*
Ilex mitis	*Dodonaea angustifolia*
Balanites aegyptaica	*Balanites aegyptaica*
Dodonaea angustifolia	*Acacia spp*
Olea africana	*Aeschnomene elaphroxylon G.*
Persea americana	*Cajanus cajan*
Celtis africana Burm.f.	

Source: Own survey result (2015).

Table 10. Cassava and pigeon pea foliage availability and utilization (percentage respondents).

	Districts					
	Loka Abaya		Amaro			
	Pigeon Pea		Pigeon Pea		Cassava	
Variables	**N**	**Percentage**	**N**	**Percentage**	**N**	**Percentage**
User farmers	19	29.3	34	40.0	59	69.3
Used form						
Fresh	19	29.0	39	46.0	64	75.0
wilted	15	23.0	3	4.0	7	8.2
Season of utilization						
Dry season	23	36.0	20	23.0	57	67.3
Short rainy	-	-	4	5.3	6	8.0
Main rainy	3	4	8	10.7	-	-
Livestock fed						
Calves	27	42.0	33	38.4	9	8.0
Lactating cow	33	50.0	49	57.7	31	36.7
Goats	27	42.0	40	47.0	11	12.7
Effect on health	-	-	-	-		
Bloating	-	-	-	-	23	27.3
Diarrhea	-	-	-	-	17	20.5

Source: Own survey result (2015). Foliage: leaves, twigs and thin stem.

production (Table 10). Cassava is used as dual-purpose crop with the tuber as human food while the foliage as animal feed. This is in line with previous study by Tesfaye et al. (2013) who showed the important role of cassava crop for human consumption, livestock feed and source of income for rural and urban households in Southern Ethiopia. The bitter variety cultivated in the district is suitable to the area and grows to a height of about two meters and the leaves stay green during late dry season (end of March). This is consistent with the report of Tesfaye et al. (2017) that reported cassava crop grown in Amaro district is bitter type containing high hydrocyanic acid. Cassava tuber also is used as supplementary feed to livestock particularly for fattening cattle and milking cows. Besides, 69.3% of interviewed households reported that cassava foliage is fed to different classes of cattle, goats and sheep. Most (75%) farmers provide the leaves in the fresh form to lactating cows and draught oxen. They also offered leaves, twigs and thin stem of cassava plant. This is in line with Wanapat et al. (2000) that revealed supplementation of cassava foliage to dairy cattle improved milk yield and composition leading to enhanced milk quality in smallholder dairy production. Smith (1988) also showed that cassava foliage is regularly fed to sheep and goats on small

scale subsistence farms in Africa. However, the respondents indicated that when the foliage is fed in very large amounts it may cause bloat and diarrhea. Sometimes utilization of immature leaves (newly emerged) caused behavioral change and restlessness in livestock.

In agreement to the current finding, feeding excess amount of immature fresh cassava foliage could be toxic to animals in Southern Ethiopia (Cherinet et al., 2008). Toxicity is due to hydro cyanide content of cassava that varies with variety, maturity and fractions of cassava plant (Smith, 1988). In Loka Abaya and Amaro districts pigeon pea was introduced to the areas by governmental and nongovernmental extension services particularly for seed production and soil conservation purposes. Cheva-Isarakul (1992), indicated that pigeon pea is grown in many countries to prevent soil erosion on step land. Farmers grow pigeon pea as annual or perennial crop following legume crop growing strategies. Some of the farmers grow the crop as a sole and intercropped with maize crop. Others grow as fence on the border of their cropland. The finding was in line with Sexana et al. (2010) who reported that pigeon pea is mainly cultivated by smallholder farmers and managed as an annual shrub or a perennial plant.

The respondents in Loka Abaya district reported that they harvest seeds for multiplication of the species and for sale. Farmers in Loka Abaya and Amaro district reported that they offer the leaves in fresh or wilted form mainly to lactating cows and goats during dry and short rainy seasons. The pigeon pea leaves used as hay if cultivated annually or as a green supplement when grown as a perennial crop during the dry season and during feed scarcity. The farmers also indicated that they feed the pods (pigeon pea haulm) of pigeon pea seeds to their livestock. In agreement with this study, Abera et al. (2010) reported that pigeon pea as a dual-purpose crop was harvested and utilized for human consumption (grain) and the residues such as leaves and pod for livestock feeding.

CONCLUSION

From the study livestock production has been shown to have an important role for the livelihood of the farmers in Loka Abaya and Amaro districts. However, the production is dominated by indigenous livestock which is characterized by low production and reproduction performance. Furthermore, small land holding, shortage of grazing land and shortage of feed supply were seen to be worse during dry season and that they were the main constraints that caused low productivity. Crop residues fed to livestock as sole feed and supplemented with horticultural crops fraction and tree leaves during dry season. Cassava and pigeon pea foliage were also important to alleviate feed shortage at critical feed scarcity time. Therefore, to sustain livestock productivity in the districts improving feed value of crop residues, cultivating dual-purpose, drought-tolerant crops and utilization of foliage as livestock feed can be feed scarcity mitigation.

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