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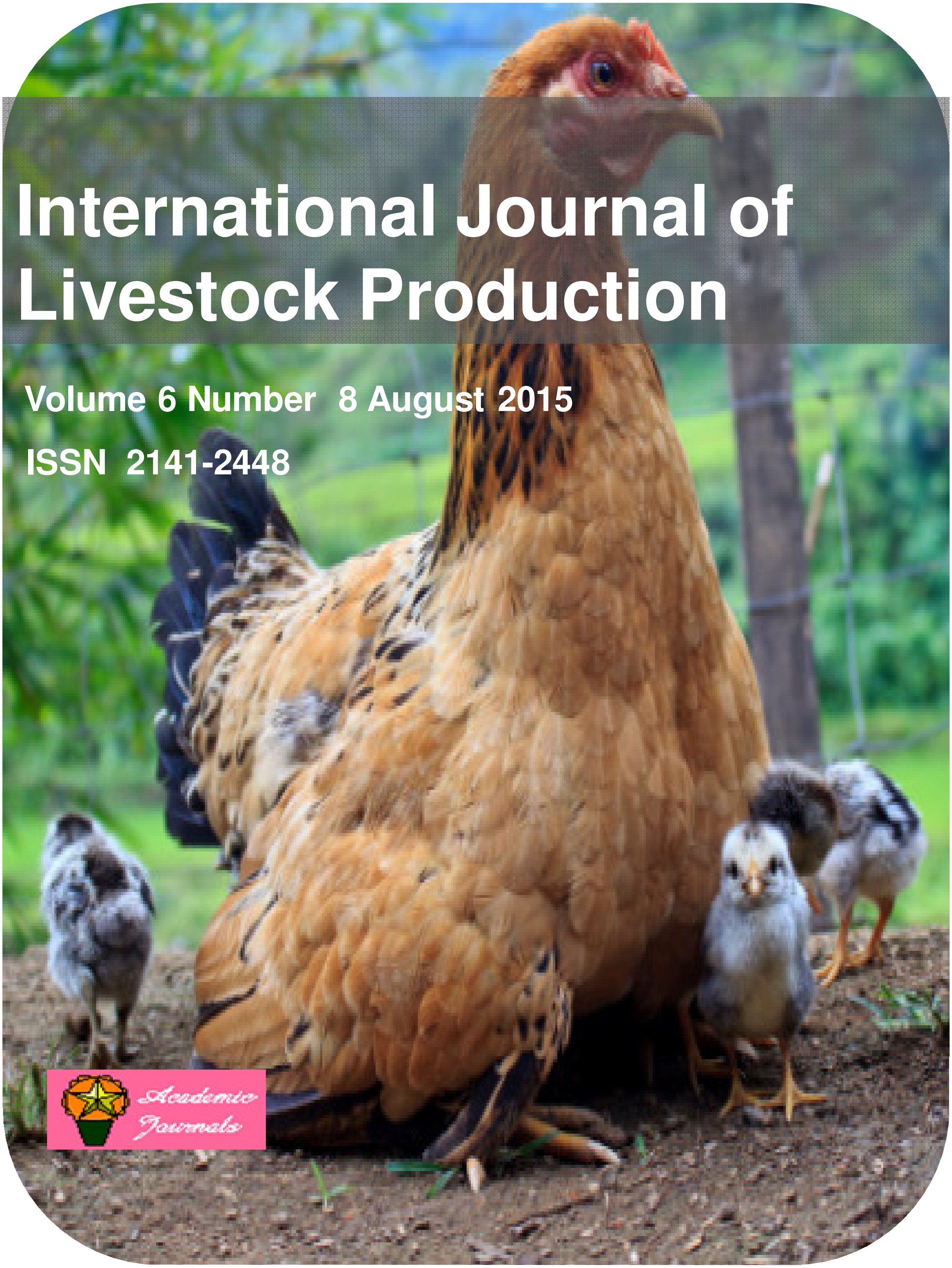

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Full Length Research Paper

Assessment of potential of natural pasture and other feed resources in sweet potato production system of Shebedino District, Sidama Zone, SNNPRS, Ethiopia

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Potential of natural pasture in Shebedino district, Southern Ethiopia was assessed. Based on availability and practice of supplementation of sweet potato vine (SPV) for livestock, 6 representative kebeles were selected from among 3 towns, 4 Degas, 15 sweet-potato-producing (SPP) and 13 sweet-potato-non-producing (SPNP) Kebeles. From each Kebele 30 households (HHs) were randomly selected and interviewed. Grazing land was protected (June-December/2013) and forage samples taken using a 0.5 m × 0.5 m quadrate from three strata. District average land holding was 0.43±0.45 ha/HH, SPP having larger land holding than that of town kebeles. In towns with no grazing land, 40% of HHs feed byproducts to livestock. In SPP and SPNP Dega Kebeles, private grazing land provided 37 to 43% of feed. All farmers feed SPV to livestock and most during dry seasons, although only 20% of the HHs cultivate sweet potato. Feed shortage was 35% of constraints to livestock production followed by low productivity of livestock (19%). At times of critical feed shortage, 50% of town-HHs sell their livestock, the rest prefer searching for supplements as mitigation strategy. Dry matter (DM) and organic matter (OM) yields ((3663±63 and 3187±50 kg/ha, respectively) of the 4th cut was the highest ($p<0.05$). Upper strata produced the highest ($p<0.05$) DM (4145±132 kg/ha) and OM (3604±112 kg/ha) yields. Similarly, DM (4145 ±132 kg/ha) and OM (3604±112 kg/ha) yields of upper strata at 4th cut were highest ($p<0.05$) of all cutting stages and strata combinations. The DM and CP contents of green grass of first cut were 33.77±3.83 and 15.17±0.00 and at the 4th cut 91.57±11.79 and 10.76±0.00%, respectively. *In-vitro* DM Digestibility of grasses of first cut was 68.11±0.00 and of 4th cut 57.8±0.04%. As family size increased, grazing land and the corresponding feed get reduced, hence decreased livestock productivity. With stage of maturity of the natural pasture, DM and OM yield increased but CP and DM digestibility decreased. Therefore conserving natural pasture as hay need be encouraged.

Key words: Digestibility, natural pasture, sweet potato producing, sweet potato non-producing.

INTRODUCTION

According to CSA (2013/14), Ethiopia owns 55,027,280 cattle, 27,347,933 sheep, 28,163,332 goat, 1,963,010 horses, 6,953,077 donkeys, 356,087 mules, 1,098,312 camels, 51,350,738 poultry and 5,052,297 beehives. These livestock play crucial role in the country's economy. They contribute 15 to 17% of GDP, 35 to 49% of agricultural GDP, and 37 to 87% of the household incomes (ILRI, 2010). Scholars (Benin et al., 2003; Jabbar et al., 2007; Negassa et al., 2011; Solomon et al., 2003; ILRI, 2011) stated that Ethiopia has huge cattle diversified agro-ecological zones and farming systems but the current level of production and productivity, at either the macro or micro level is below its potential. The levels of foreign exchange earnings from livestock and livestock products are much lower than expected. The major causes are diseases/parasites, feed shortage, water shortage, labor shortage, drought, predators, lack of technologies/inputs, inadequate extension support and vet service and lack of capital.

Although livestock play a decisive role in rural and urban areas in SNNPRS in general and more specifically in the areas included in this study, it is not only constrained by feed shortage and quality but also characterized by food insecurity, land degradation, land shortage and poor soil fertility (Alemayehu, 2003). In addition to this, the rapidly increasing human population imposed pressure on farm land size that lead to expansion of crop production at the expense of grazing areas that eventually leads to shortage of livestock feed, however sweet potato production provides the vine and leaves which are valuable livestock feeds (Netsanet, 2006). As a result, animals are not able to satisfy their nutrient requirements and resulting in weight loss and low productivity.

This experiment was conducted with the objectives to assess feed resources and mitigation strategies related to livestock feeding; and to determine biomass yield and *in vitro* digestibility of the natural pasture in the communal grazing land in Sidama Zone, southern Ethiopia.

MATERIALS AND METHODS

Description of the study area

The study was conducted in Shebedino district of Sidama Zone, Southern Nations, Nationalities and People's Regional State (SNNPRS). The District is 197.1 km^2, lies between 1800 to 2950 m. a. s. l, receives between 900 and 1500 mm rainfall with mean annual temperature between 16 and 25°C. It has two rainy seasons: June-September and February-April; two agro-ecological zones: Dega (>2500 m. a. s. l, 9.4% coverage and has 4 Kebeles) and Weinadega (1800-25000 m. a. s. l, 90.4% coverage and has 31 Kebeles). The district has 35 administrative Kebeles and 3 are in town, 32 in rural areas. The study area shares common border with Hawassa town, Dale, Gueriche and Borecha districts (SDAO, 2013).

Diagnostic survey on population characteristics, land holding, livestock and feed resources

Sampling techniques of kebeles

According to Extension Department experts' of Shebedino district Agricultural Office, the district is classified in to four main groups based on availability or scarcity of green byproduct forage for supplementing during dry season. Accordingly, categories were: (1) "Town = no sweet potato plantation due to land limitation'; (2) 'Dega = no sweet potato plantation due to agro ecology; (3) 'Sweet-potato-producing = engaged in sweet potato plantation because ecology is suitable', and (4) 'non-sweet-potato-producing = not engaged in sweet potato cultivation although the ecology is suitable".

Based on the above classification, one from three Town Kebeles, one from four Dega Kebeles, two from 15 sweet-potato-producing Kebeles and two from 13 non-sweet-potato-producing Kebeles representative Kebeles were randomly. From each of the six Kebeles, 30 households (HHs) were randomly selected and interviewed.

Sampling technique for biomass determination

The representative communal grazing land was 53 by 99 m (5247 m^2). It was observed that, water was flowing during rainy season from the upper north to the lower south. After stratifying it into upper, middle and lower; biomass was assessed using a 0.5 m × 0.5 m quadrate (0.25 m^2).

According to Mannetje (2000), the sample representative area size for 5247 was 6.75 M^2. This area was sub divided in to 27 quadrates 0.25 M^2 size each. For positioning, 3 quadrates in each sub strata systemic sampling procedure was used (the sub stratum was divided in to three horizontal equal parts and three threads were stretched horizontally). On the thread, three points at equal distance were marked and the mark points on the thread were positioned on the ground and that point was taken as the centre of the quadrate. The 27 quadrate areas were closed for cutting trials. At each cutting period, 3 quadrates at each sub stratum were randomly selected. First cut was conducted 30 days after closure (06/01/13 to 06 /30/13); second, 62 days after closure (06/01/13 to 06 /30/13); third, 92 days after closure (06/01/13 to06 /30/13); and the fourth, after 7 months (223 days) of closure (06/01/13 to06 /30/13). In each sub-stratum, immediately after cutting, fresh weight was taken, then after thorough mixing, 1/3 of it was sub-sampled.

Data collection

Primary data on household characteristics, land holding size and utility, livestock holding size by type, available feed resources, livestock constraints and mitigation strategies were collected using a pre-tested semi-structured questionnaire. Secondary data were collected from the District sectors, Central Statistics Agency of Hawassa branch, Regional Bureaus and Zonal Coordinating Offices.

In vitro dry matter digestibility

In vitro studies were conducted to estimate the potential digestibility of the poled sample of the four round forage cuts. The *in vitro* dry matter digestibility (IVDMD) was determined using the two stages *in vitro* according to Tilley and Terry procedure (1963) as modified by Van Soest and Robertson (1985).

Chemical analysis

The chemical analysis of forage samples was carried out at Hawassa University Animal Nutrition laboratory. Representative

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samples were dried at 65°C and ground separately in Thomas–Wiley Laboratory mill (Model 4) to pass through 1 mm sieve for chemical analyses and 2 mm sieve for *in vitro* studies. Samples were analyzed for DM, OM and ash and EE according to AOAC (1990). The DM and OM yields from the quadrates were converted on to hectare-basis by multiplication using the correction factor 10,000. The N content was determined by the Kjeldhah method and the CP content was calculated as N × 6.25 (Gurbuz and Davies, 2010). Neutral detergent fiber (NDF), acid detergent fiber (ADF) and acid detergent lignin (ADL) were analyzed according to Van Soest et al. (1991).

Data management and statistical analysis

Descriptive statistics and/or *chi-square* were employed to describe the various variables of the survey data. The data on chemical composition and in-vitro studies were subjected to descriptive analysis and biomass yield to analysis of variance using General Linear Model (GLM)/ Univariate and multivariate) procedures of SPSS Version 22 (IBM SPSS, 2014). Means were compared using Duncan's multiple range tests. Means were declared significant at p<0.05.

The model used for statistical analyses of DM and OM yields of forage from natural pasture of the three strata cut four times was: $Y_{ij} = \mu + \alpha_i + \theta_j + \alpha_i\theta_j + e_{ij}$; where: Y_{ij} = DM or OM yield; μ = overall mean; α_i = effect of i^{th} cutting time on DM or OM yield (i = 1^{st}, 2^{nd}, 3rd and 7^{th} month of closure age); θ_j = effect of j^{th} strata of the grazing land on DM or OM yield (j = upper, middle and lower strata); $\alpha_i\theta_j$ = interaction effect among i^{th} cutting time and j^{th} strata on DM or OM yield; e_{ij} = random error.

RESULTS AND DISCUSSION

Diagnostic survey

Household characteristics

The average family size of the District was 7.07±2.43 which was larger in sweet potato-producing Kebeles and lowest in Town Kebeles; non sweet-potato producing while Dega Kebeles are found in between. The current family size is higher than earlier reports (Nigatu, 2011; FPENUNS, 2010).

Size of land holdings

Overall average land holding size was 0.43±0.45 ha per household (HH), largest land holding was found in sweet-potato-producing (SPP) followed by non-sweet potato producing (NSPP), Dega and Town Kebeles in decreasing order (Table 1). The average land holding size of the district was much lower than that of rural HHs of Adami Tullu Jiddo Kombolca district (2.66±2.1), Badiwach (1.29ha) and Soddo Zuria (0.58-0.96 ha), Walayita Zone (Duressa, 2007; Netsanet, 2006; Adugna, 1990). Grazing land in NSPP Kebeles was much lower than those of some rural areas of Southern Ethiopia such as Sinana and Dinsho districts in Bale Zone (Solomon, 2004) and Adami Tullu Jiddo Kombolcha district (Duressa, 2007), Badiwach (0.15ha±0.005) and Soddo Zuria (0.14±0.006) of Walayita Zone (Netsanet, 2006).

Livestock species composition and ownership (number per household)

The survey indicated that cattle, sheep, goat, equine (donkey) and poultry (indigenous, Rhode Island Red and White Leghorn) are dominant livestock species. There were more cattle per HH than other species. In Dega Kebeles HHs owned more cattle which disagrees with earlier reports for neighboring places such as Adami Tullu Jiddo Kombolcha District (Duressa, 2007), Southern Ethiopia in pastoral and semi pastoral areas (Adugna and Aster, 2007) and Badewacho and Soddo Zuria, Walayita Zone (Netsanet, 2006). The lowest number of cattle per HH was observed in towns. Mean cattle holding size within all Kebeles was much lower than that reported (10.96TLU) for Adami Tullu Jiddo Kombolcha District (Duressa, 2007), (8.65TLU) for Sinana and (11.52TLU) for Dinsha (Solomon, 2004) and (10.96TLU) for Badewacho and Soddo Zuria districts (Netsanet, 2006). The smaller TLU per HH in Shebedino district could be attributed to shrinkage of grazing land. Mean sheep holding size followed cattle trend but was nil in Town. Number of equines per HH was the lowest of all and it was absent in Town and Dega. Dega Kebeles were rearing more cows, heifers, calves and sheep.

Feed resource availability and method of feeding

The available feed resources and methods of feeding are presented in Table 2. In town and its periphery, there was no private grazing land at all thus, about 40% of HHs use byproducts followed by communal grazing land (open areas). Private grazing land contributed to more than 1/3 of feed sources in Dega, sweet-potato-producing and non-sweet potato producing Kebeles followed by communal grazing land, private and purchased crop residues.

At national level, green fodder contributes more than half, whereas crop residues nearly 1/3 and the rest come from hay and industrial byproducts. In SNNPRS, green fodder contributes 75% of total feed sources which is much higher than the national figure. Crop residue production is nearly equal to the national figure while hay and byproducts contribute only 2% of the total feed resources which is slightly less than the national figure (CSA, 2009).

The overall contribution of green fodder to livestock feeding from private and communal grazing land was 57% in Shebedino district which was lower than regional but comparable with that of national figures. Netsanet (2006) reported that the natural pasture in the wet season at Badewacho contributed 79% while in Soddo Zuria it

Table 1. Land holding size (ha, Mean ±SD) and utility in sampled Kebeles.

Land types	Town	Dega	SPP	NSPP	Range	Mean
1	0.04±0.01	0.34+0.25	0.65+0.52	0.43+0.42	0.02-2.27	0.43±0.45
2	0	0.13±0.21	0.36±0.41	0.18±0.32	0.0-0.34	0.20±0.34
3	0	0.17±0.07	0.02±0.04	0.02±0.08	0.0-0.05	0.01±0.05
4	0	0	0.02±0.02	0.02±0.08	0.0-0.03	0.01±0.03
5	0	0.02±0.05	0.06±0.08	0.03±0.06	0.0-0.06	0.03±0.06
6	0	0.02+0.05	0.03±0.05	0.01±0.04	0.0-0.04	0.02±0.04

1 = land for annual crop; 2 = land for perennial crop; 3 = land for root crop; 4 = land for vegetable; 5 = forest land; 6 = grazing land, SPP = sweet-potato-producing, NSPP = non-sweet potato producing.

Table 2. Ranking of the feed resources in representative Kebeles of Shebedino district of Sidama zone (N=180) in southern Ethiopia.

Feed resources		Kebeles				Total**, N (%)
		TK*, N (%)	**DK***, N (%)	**SPP***, N (%)	**NSPP***, N (%)	
Grazing land	Private	0	12 (40)[e]	26 (43)[f]	22 (37)[e]	60 (33)[h]
	Communal	6 (20)[d]	7 (23)[d]	13 (22)[e]	17 (28)[d]	43 (24)[g]
	Hired	0	0	2 (3)[a]		2 (1)[b]
Crop residues	Private	4 (13)[c]	5 (17)[c]	9 (15)[d]	12 (20)[c]	30 (17)[f]
	Purchased	4 (13)[c]	0	7 (12)[c]	5 (8)[b]	16 (9)
Hay	Private	1 (3)[a]	4 (13)[b]	0	0	5 (3)[c]
	Purchased	1 (3)	0	0	0	1 (1)
Private fodder tree		2 (7)[b]	2 (7)[a]	0	4 (7)[a]	8 (4)[d]
Industrial byproduct		12 (40)[e]	0	3 (5)[b]	0	15 (8)[e]
Total		30 (100)	30 (100)	60 (100)	60 (100)	180 (100)
Test	χ2	120	168	168	605	1260
	p-value	0	0	0	0	0

TK =Town Kebeles; DK = Dega Kebeles; SPP = Sweet potato producing Kebeles; NSPP = Non sweet potato producing Kebeles; N = number of respondents. Row values with different superscript letters are significantly different.

was 70% which were still much higher than that of Shebedino district. The difference could be attributed to the variation in land use system where more land is assigned to crop production especially to perennial crops such as coffee than grazing land. Getnet and Ledin (2000) reported that livestock are mainly dependent on crop residues and natural pasture as sources of feed which agrees with the result of this study. Practice of feeding hay in the District was lower than the national but comparable with that of regional experience. More HHs were feeding byproducts to livestock in the district than at national and regional levels. It can thus be concluded that hay making is a less common practice in the region and district.

Utilization of sweet potato vine as animal feed

Only very few of the respondents of the sweet-potato-producing Kebeles produce sweet potato but none from the other Kebeles. Adugna and Said (1992) reported that in Badewacho and Soddo Zuria, sweet potato vine as well as *enset* and cassava leaves were used during dry seasons as feed resource but in our study only few farmers used it perhaps due to lack of adaptation by farmers. All the farmers, who plant sweet potato, have used the sweet potato vine as feed supplement. Utilization of sweet potato vine as feed supplement and the method of utilization vary significantly ($p<0.05$) during different seasons of the year. Nearly 2/3 of respondents feed sweet potato throughout the year, less than 1/3 during the dry season and few used it only during wet season. Adugna and Said (1992) reported that in Walayita, most of the farmers utilize sweet potato vine, *enset* and cassava during the dry season which differs from the result of this survey perhaps due to differences in adaptation of use of sweet potato vine which resulted from week extension service.

Table 3. Ranking constraints of live stock production in Kebeles of Shebedino district, Sidama Zone (N=180), southern Ethiopia.

Constraints		Kebeles				Total, N (%)
		TK, N (%)	**DK,** N (%)	**SPP,** N (%)	**SPP,** N (%)	
Feed shortage		14 (47)[e]	8 (27)[a]	19 (32)[g]	22 (37)[g]	63 (35)[f]
Less productive land		3 (10)[c]	3 (10)[b]	8 (13)[d]	4 (7)[c]	18 (10)[c]
Less productive animals		6 (20)[d]	6 (20)[d]	10 (17)[f]	13 (22)[f]	35 (19)[e]
Disease		2 (7)[b]	3 (10)[b]	7 (12)[c]	3 (5)[b]	15 (8)[b]
Predators		2 (7)[b]	3 (10)[b]	5 (8)[b]	8 (13)[d]	18 (10)[c]
Water shortage		1 (3)	2 (7)	2 (3)	1 (2)	6 (3)
Theft		2 (7)[b]	5 (17)[c]	9 (15)[e]	9 (15)[e]	25 (14)[d]
Total		30 (100)	30 (100)	60 (100)	60 (100)	180 (100)
Test	χ2	120	120	360	360	900
	p-valve	0.000	0.000	0.000	0.000	0.000

TK=Town Kebeles; DK=Dega Kebeles; SPP= Sweet potato producing Kebeles; NSPP= Non sweet potato producing Kebeles; N=number of respondents. Row values with different superscript letters are significantly different.

Table 4. Ranking mitigation strategies of livestock constraints taken by farmers in representative kebeles of Shebedino district, Sidama Zone (N=180), southern Ethiopia.

Kebeles	Feed supply	Selling animal	Trans- humanism	Transfer to kinsman	Total	Test	
	N (%)	N (%)	N (%)	N (%)	N (%)	χ2	p-value
TK*	6 (20)[b]	15 (50)[c]	3 (10)[a]	6 (20)[b]	30 (100)	60	0
DK*	19 (63)[c]	3 (10)[a]	4 (13)[b]	4 (13)[b]	30 (100)	60	0
SPP*	36 (60)[c]	9 (15)[b]	9 (15)[b]	6 (10)[a]	60 (100)	120	0
NSPP*	27 (45)[d]	14 (23)[c]	7 (12)[a]	12 (20)[b]	60 (100)	180	0
Total*	88 (49)[d]	41 (23)[c]	23 (13)[a]	28 (16)[b]	180 (100)	540	0

TK = Town Kebeles; DK = Dega Kebeles; SPP = Sweet potato producing Kebeles; NSPP = Non sweet potato producing Kebeles; N = number of respondents. Row values with different superscript letters are significantly different.

Livestock feeding methods, their constraints and mitigation strategies

Nearly 60% of the respondents used free grazing followed by stall feeding but the two systems were not practiced together by farmers and thus was given the lowest rank (Table 3).

Feed shortage was most important constraint in Towns, followed by Dega, SPP and NSPP Kebeles which agree with the results of studies of Tsedeke (2007) and Yenesew (2009) where DM supply to livestock in moist highland crop-livestock, sub-moist highland crop-livestock and sub-moist low land crop-livestock systems was in the negative balance.

In towns, selling livestock is the most commonly used option to overcome the feed shortage (Table 4). Irvin (2000) put that farmers combat feed shortages by feeding livestock with feeds normally intended for human beings such as sweet potato tubers, maize and *enset*, which is normally reserved for animals at risk. In similar way, Adugna et al. (2000) asserted that at national level, the traditionally grown sweet potato tuber is used for human consumption and the byproduct (vine) used as feed supplement. Reports of both studies are compatible with the results of this study. On the other hand, supplementation of feed from any source is the primary options in sweet-potato-producing and non-sweet-potato-producing Kebeles of Dega.

Forage biomass productivity of the grazing land

As shown in Table 5, DM and OM yield of the first three cuttings were similar ($p>0.05$) but they were lower than that of the fourth cutting ($p<0.05$).

There was a significant difference in production of DM and OM among strata (Table 5). The upper stratum produced greater overall DM and OM yields than the middle and lower strata. The difference could be attributed to fast drainage in upper stratum and accumulation of flood debris resulting in water logging in the middle and lower stratum. The forages DM and OM yields at any strata at the fourth cut were more than at cuts 1, 2 and 3 ($p<0.05$).

Table 5. Biomass production (Mean± SE) of grass mixture in four cutting times and three strata.

Parameters	Cuttings	Yield (kg/ha)	
		DM	OM
Cutting time	1st	1436.8±62.69[a]	1250.4±50.41[a]
	2nd	1235.9±62.69[a]	1076.6±50.41[a]
	3rd	1380.2±62.69[a]	1161.0±50.41[a]
	4th	3662.7±62.69[b]	3186.7±50.41[b]
	Strata		
Green cuts mixture (1-3)	Upper	1484±76[a]	1271±65[a]
	Middle	1241±76[a]	1077±65[a]
	Lower	1328±76[a]	1139.7±65[a]
Dry cut mixture (4th)	Upper	4145±133[c]	3604±112[c]
	Middle	3426±132[b]	2981±112[b]
	Lower	3417.6±132[b]	2975±112[b]

DM = dry matter; OM = organic matter. Mean values within a column with different superscript letters for cuttings and strata are significantly different (p<0.05).

Table 6. The dry matter, nutrient contents and *in vitro* dry matter digestibility (Mean ±SE) of the natural pasture harvested green (first three cuttings) and dry (4th cutting) in Shebedino district.

Nutrient (% DM)	Natural pasture	
	Green cuts(1-3) mixture	Dry cut(4th) mixture
Dry matter (%)	33.77±3.83	91.57±11.79
Organic matter	86.14±1.77	87.01±0.16
Crude protein	15.17±0.00	10.76±0.00
Ether extract	13.47±0.31	7.37±0.35
Neutral detergent fiber	62.85±0.06	63.85±0.85
Acid detergent fiber	30.24±0.01	30.83±0.36
Acid detergent lignin	18.60±0.08	21.38±0.02
Digestibility (%)		
In-vitro dry matter digestibility	68.11±0.00	57.8±0.04

SE = standard error.

Dry matter content, yields and digestibility of the natural pasture

Nutrient contents and *in vitro* dry matter digestibility of the natural pasture of the grazing land at two cutting stages are depicted in Table 6. The DM yield of mixture of forage of the first three cuttings was more or less similar with the results of the study on mixture of guinea grass with *Stylosanthus guianensis* (*stylo)* at a ratio of 2:2 and 3:1 harvested 150 days after sowing that gave the same relative yield; but any mixture of guinea grass with *S. guianensis* (stylo), *C. pubescens* (centro), burgundy bean and *A. pintoi* at any ratio was greater than the DM yield in this study. The DM yield of mixture of forages from the first three cuttings in this study agreed with that of Bua et al. (2001) and Tikuneh (2009) but it was greater than that reported by Tegene et al. (2010) for Umbulowacho watershed. This could be attributed to variability in rain fall, cutting time, soil type and topography. The reports of MoA for 1984 agreed with the different highland zones of Low Potential Cereal Livestock Zone (LPC/LZ) and seasonal water logged soil while the study of Sisay (2006) nearly agreed with the DM yield of the 4th cuts.

The mean CP content of this study for 1-3 cuts' mixture period match with that of the open area but the CP content of this study of 4th cut was lower than that of closed, medium and low altitudes (Tegene et al., 2010). According to same authors, CP content of the green forage was comparable with open area that received animal dung and urine and low altitude that received valuable nutrient brought from the upper areas via flood and erosion; while the low CP content at 4th cut of this study was caused by over maturation and that may be comparable with that of closed area that was devoid of animal dung and urine and that of the medium and high altitudes caused by removal of nutrient by soil erosion. In this study, as maturation increased, CP content slightly decreased which agrees with the report of Tegene et al. (2010).

The NDF and ADF contents of the forage between the first three cuttings and 4th cutting were nearly similar which disagree with Tikuneh's (2009) report but were similar to that of Tegene et al. (2010). As the stage of maturity of the forages in the natural pasture increased the ADL content increased but in the study of Tegene et al. (2010), as the closure period increased, there was no change in the ADL content for the probable reason that there is re-growth with less lignified forages. In this study, high DM and ADL and low CP contents decreased IVDMD which agrees with the results of earlier studies (Tikuneh, 2009; Tegene et al., 2010).

Conclusion

There was variability in family size between Kebeles. Households (HHs) with more land had larger family size. In towns HHs had less land and low family size. As land size/HH increased, size of livestock holding also increased and the vice versa.

The major constraint for livestock production was feed shortage followed by low productivity of livestock. Town residents sell their livestock, while in Dega, sweet-potato producing (SPP) and non-sweet-potato producing (NSPP) areas, HHs use feed supplements as a primary mitigation option.

Byproducts are the major feed sources and are mainly privately produced by rural HHs. Green forages; either from private land or communal grazing land covers more than half of feed resources. There were only very few farmers planting sweet potato due to weak extension service and lack of awareness. Majority of the sweet-potato producing farmers fed the vine to their livestock after wilting during the dry as well as wet seasons. Upper side of the natural pasture was well drained and produced better forage biomass yield. The flooding debris at the bottom has contributed to better biomass yield especially during the drier part of the year. As stage of maturity increased, there was an increase in DM and OM yield but decreased CP, EE and DM digestibility. The CP content was directly related while ADL was inversely related to DM digestibility. Designing appropriate plan for grazing and conserving forages from the three strata of the natural pasture is thus recommended.

Conflict of Interest

The authors do not declare any conflict of interest

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