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Original Research

Feed Resources and Livestock Production Situation in the Highland and Mid Altitude Areas of Horro and Guduru Districts of Oromia Regional State, Western Ethiopia

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Abstract

A survey was conducted in the highland and mid altitude areas of Horro and Guduru districts of Horro Guduru Wollega Zone of Oromia Regional State, western Ethiopia with the objectives of assessing livestock production situation, livestock production constraints, major feed resources and their potential contribution. A single-visit multi subject formal survey method was used in the survey. A total of 210 household heads, 60 from highland and 150 from mid altitude areas were selected and interviewed. The average land holding was 4.43±0.26 ha per household in the highland and 3.98±0.11 ha in the mid altitude areas. The average size of grazing lands of highland respondents (0.73±0.08 ha) was significantly higher (P<0.001) than that of mid altitude (0.47±0.03 ha). Similarly, the average livestock holdings of highland respondents (13.00±0.60 heads) were significantly higher (p<0.001) than that of mid altitude livestock holding (9.72±0.45 heads) in which cattle dominates other species. Feed shortage, health problem, poor genetic potential, labour and water shortage were listed as major constraints for livestock production. Natural pasture, cop residues, stubble grazing were listed as major feed resources, with minimal contribution of improved forages and local beverage by products (Diqi or atela). Disappearance of better quality and palatable species of grasses, expansion of invasive plants like Raphanus raphanistrum and Parthenium hysterophorus, and depletion of soil nutrients were listed as factors affecting the quality of grazing land. An average of 11.55 and 13.89 tons of feed dry matter (DM) was produced per household of highland and mid altitude, respectively, of which about 74.03% of the feed in highland and 80.63 % in mid altitude were obtained from crop residues. The contribution of private grazing land was estimated to be 11.7 and 6.41 % of the total feed supply from the private holdings in highland and mid altitude areas, respectively. The contribution of stubble (after math grazing) was estimated to be 14.81 and 13.03 % of the feed that can be obtained from private holdings.

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INTRODUCTION

Agriculture contributes 47% of the country's GDP and more than 80% of the export earning and employs over 85% of the population of Ethiopia. The livestock sector contributes 16.5% of the total GDP, 45% of agricultural GDP (Behnke, 2010) and 37-87% of the household incomes (MOFED, 2011). Ethiopia is endowed with high livestock population distributed in the different agro ecological zones of the country (Alemayehu 2006). The commonly available livestock feed resources include natural pastures, crop residues, improved forage and agro industrial products (Adugna *et al*., 2012).

In the highlands where mixd crop livestock production system predominates, the areas of grazing lands are highly fragmented and limited to areas where conditions are adverse for cropping due to topographic, edaphic and climatic conditions. According to CSA (1998) about 93.5% of the highlands are allotted for temporary and permanent crops. Therefore, crop and livestock sub sectors compete for scarce farm resources causing inadequate feed supply, both in quality and quantity (Adugna *et al*., 2000). As a result, livestock productivity is generally lower than the potential (EARO, 1998; CSA, 2013). This is true in Horro and Guduru districts as well.

This necessitates assessment of the livestock production situation, feed resources availability and the prevailing livestock feeding practices in order to better

understand the system and alleviate the constraints. Therefore, this study was initiated with the objectives of assessing the livestock production situation, livestock production constraints, available feed resources in relation to requirements of livestock in Horro and Guduru districts of Oromia Regional State, western Ethiopia.

MATERIALS AND METHOD

Description of the Study Area

The study was conducted in Horro and Guduru districts of Horro Guduru Wollega Zone of Oromia Regional state, Western Ethiopia. The two districts are found between 36°-37 °E longitudes and 9°-10° N latitude. Horro district has 22 kebeles (the lowest administrative unit). It lies in altitude range of 1450 - 3100 m.a.s.l.with annual rainfall ranges of 900-1800 mm and mean daily temprature ranging from 11.8 to 22.7 ^{0}C. Guduru district has 28 kebeles. It lies between an altitude ranges of 1500 – 2296 m.a.s.l., with annual rainfall range of 1000–2400 mm and average daily temperature varing from 14.9 ^{0}C to 17.5 ^{0}C. The climate of the two study areas are characterised by two distinct seasons, rainy (*Gana*) and dry (*Bona*).The two districts have one long rainy season extending from March to mid-October (Buzuayehu, 2006; Ayantu, 2013).

Sampling Technique

A single-visit multi subject formal survey method (ILCA, 1990) was used in the study. The districts were clustered into highland and mid altitude agro-ecologies.Then, 2 kebeles from the highland and 5 kebeles from the mid altitude areas were purposively selected according to the size of the two agro-ecologies and 30 household heads were randomly selected from each kebele for interview. The criteria for selection of the respondents included livestock holding, accessibility and experience of keeping livestock. Thus, 60 respondents from the highland and 150 respondents from mid-altitude giving a total of 210 respondents.

Types of Data and Methods of Data Collection

Data was collected both from primary and secondary sources. The primary data was collected from smallholder farmers using semi-structured questionnaire. Focuse group discussions with experienced farmers were made at each Kebele.The questionnaire was first pre tested before the commencement of the survey and filled by trained enumerants with close supervision of the first author.

Estimation of Annual Feed Resources and Livestock Feed Requirement

For herbage yield estimation of grassland, twenty representative enclosures, ten from highland and ten from mid altitude were selected by ealderly people. Then three samples at quadrat size of 0.5 mx 0.5 m were taken from the selected grazingland diagonally at 10 meter difference for each of the two agro-ecologies. The samples were harvested by hand using sickle at approximately 2 cm above the ground (Mannetje, 1978). For estimating biomass yield fresh samples were dried at 105 ^{o}C for 24 hours. Then the dry matter (DM) obtained from different sites were used for extrapolation of total dry matter obtained from hectare of land per household.

The quantity of feed dry matter (DM) obtained from crop residues (maize stover, straws of wheat, barley and teff, etc) per household was estimated from crop yield to crop residue ratio using conversion factors of FAO (1987). The quantity of crop residue on the basis of DM available and those actually available for livestock consumption was estimated by deducting 10% of the same as wastage (Adugna and Said, 1994). The quantity of feed DM obtained annually from aftermath was estimated by multiplying the area of cultivated land by 0.5 tDM/ha/year (FAO, 1987). The livestock population per household was converted to tropical livestock unit (TLU) as recommended by Gryseels (1988) and Abidinasir (2000). The DM requirement was calculated based on daily DM requirement of 250 kg dual purpose tropical cattle (an equivalent of one TLU) for maintenances according to Kearl (1982).

Statistical Analysis

Primary data from surveyed households was organized and analyzed using Statistical Package for Social Science (SPSS version 17.0). Mean and percentage values of various parameters were compared between the two study locations and inidices were calculated for ranking data using the formula: Index = ∑ of [3 for rank 1 + 2 for rank 2 + 1 for rank 3] for overall reasons/criteria.

RESULTS AND DISCUSION

Household Characteristics

The average family size of respondents in the highland was 7.12±0.31 persons and that of the mid altitude area was 6.87±0.23 persons with no significant difference (p>0.05) between the two agro-ecological areas. Average family size of the surveyed households were similar with the family size reported for Fogera, Jeldu, Diga districts and Central highlands of Ethiopia having similar agro–ecologies and livestock production system (Bedasa *et al*., 2012; Ayele *et al*., 2012: Ahimed *et al*., 2010 and Desta *et al*., 2002). However, the result was lower than 9.92 persons reported for Adami-Tullu Jiddo-Kombolcha district (Dawit *et al*., 2013) but higher than national average of 4.9 persons per household reported for rural areas Ethiopia (EDHS, 2012; Tegene *et al*., 2015). The comparatively large family size reported in the current study could be due to lack of awareness towards family planning measures and the local perception of considering large family size as an asset for agricultural activities.

Table 1: Mean age (mean±SE) structure of the surveyed households

Variables	High land	Mid altitude	Overall	Significance
	N = 60	N = 150	N = 210	
Average age of respondents (year)	40.32±1.02	41.39±0.91	41.08±0.71	NS
House hold size	7.12±0.31	6.87±0.23	6.94±0.18	NS
Male	4.02±0.21	3.42±0.13	3.59±0.12	*
Female	3.10±0.20	3.45±0.14	3.35±0.11	NS

N = number of respondents, NS= non significant, *, p<0.05

Landholding and Land Use Pattern

Mean landholding and land use pattern of surveyed households is shown in Table 2. The average private land holding (4.43±0.26 ha) of highland respondents was not significantly different (p>0.05) from mean land holding (3.98±0.11 ha) of respondents from the mid altitude area. Comparable size of landholding of 3.78 ha/hh reported for Mulo Sululta area of Selale (Desta *et al*., 2002). The average landholding reported in this study area is also comprable with the report of (Zelalem, 1999) who observed 4.9 ha/hh and 3.0 ha/hh for Holeta and Selale areas of Central Ethiopia, respectively and larger than 2.5 and 1.55 ha/hh reported for Dendi and Bure district (Belay *et al*., 2012; Shitahun *et al*., 2009). Larger landholding is assumed to provide an opportunity for land allocation to grazing lands, while the current study and overall scenario in Ethiopia tends to prioritize the available small land size for crop production.

There was no significant difference (p>0.05) between the two agro-ecologies in the average holding of cultivated land, whereas the average area of private grazing land was significantly (p<0.001) higher in the highland than in the mid-altitude area. The difference in the amount of grazing land between the two agro–ecologies could be seen as a result of the absence of bordering lowlands around study areas of Horro highlands that could be used to move livestock during pick feed shortage after all the land is cultivated.

Table 2: LSM and SE for land holding (ha) and use pattern per household of the respondents

Land use	HIGHLAND (N=60)	Mid altitude (N=150)	Overall N = 210	Significance
Cultivated	3.70±0.26	3.51±0.11	3.56±0.11	NS
Grazing land	0.73±0.08	0.47±0.03	0.54±0.03	***
Total	4.43±0.26	3.98±0.11	4.11±0.11	NS

***= p<0.001; NS=not significant; N= number of respondents; SE=standard error

Livestock Holding

The average livestock holding per household is summarized in Table 3. The livestock species kept by farmers comprises of cattle, sheep, goats, donkeys, horses, and mules. The result shows that cattle is the dominant livestock species reared in both agro ecologies and there was no significant differnce (p>0.05) in cattle holding between the two agro-ecologies. The higher proportion of cattle rearing in the two agro ecological areas could be due to high demand of cattle for cultivation and other farm activities in the area. Cattle breeds kept by the surveyed households are the local Horro breed. The overall average number of cattle holding of 9.74±0.39 for highland and 9.24±0.43 for mid altitude reported in present study areas were comparable with the previously reported values of 9.66 TLU for Selale (Kelay *et al* 2002) and 9.3 TLU for Horro (Edea *et al*., 2012). However, the average number of cattle holding in the current study was higher the average livestock holding of 4.53 TLU of cattle holding that was reported by Belay *et al*. (2012) for central Ethiopia. On the other hand, Solomon *et al*. (2014) reported higher livestock holdings for Pawe, Dibase, Wombara and Guba districts of Metekel Zone of Benishangul-Gumuz Region in western Ethiopia.

The sheep and goats holdings were significantly (p<0.001) higher in the highlands than in the mid-altitude area, which could be due to the presence of higher area of grazing land in highland than mid-altitude area (Table 2). The number of donkeys held in both study agro-ecologies seems similar, but numerically large number of donkeys were kept in mid altitude areas. The number of horses and mules kept per household were significantly higher (p<0.001) in the highland than in mid altitude area. This could be attributed to more suitability of the highland for horse and mule rearing with lower incidences of diseases and larger area of grazing land as compared to the mid-altitude area.

The overall livestock holding of 13.0 TLU/hh in the highland was significantly higher (p<0.05) than that of the mid-altitude area (9.7 TLU/hh). The total livestock holding in the current study is comparable with previous reports for Dendi district of West Shewa Zone of Oromia Regional State (Belay *et al*., 2012; ZEdea *et al*., 2012) but higher than that the values reported for mid-altitude areas of Borena Zone (Dejene, 2014) and for Central Highlands of Ethiopia (Ahimed *et al*., 2010) as well as for Diga, Jeldu and Fogera districts (Bedassa *et al*., 2012).

Table 3: Least square mans & standard errors for livestock holdings per household of the respondents in the study area

Specises	Highland (N=60)	Mid altitude (N=150)	Overall (N=210)	Significance
Cattle (TLU)	9.74±0.39	9.24±0.43	9.38±0.33	NS
Sheep (TLU)	0.77±0.07	0.18±0.02	0.34±.0.03	***
Goats (TLU)	0.60±0.07	0.22±0.03	0.33±0.03	***
Donkeys (TLU)	0.54±0.07	0.65±0.04	0.62±0.03	NS
Horses (TLU)	2.56±0.27	0.22±0.05	0.89±0.11	***
Mule (TLU)	0.11±0.04	0.03±0.01	0.05±0.02	*
Total Livestock	13.00±0.60	9.72±0.45	10.65±0.38	***

N = Number; NS = Non-significant difference; * = p<0.05; *** = p<0.001

Constraints of Livestock Production

The results of the semi-structured interview, focus group discussions and field observations revealed that feed shortage, disease and parasites, shortage of labor, low genetic potential of indigenous breeds, and water shortage were the main constraints affecting livestock production in both agro-ecologies of both districts in decreasing order of importance (Table 4). This is in line

with previous studies in different parts of the country (Shitahun, 2009; Belay *et al*., 2012).

The problem of feed supply was reported by about 91.7% of respondents from the highland and 70.7% respondents from mid-altitude area. Feed and feed related problems such as shortage of feed supply, death of cattle due to bloating, less reproductive and productive performance of animals were listed as major constraints. During the wet season, the grazing lands in the study areas contain a significant proportion of clover (*Trifolium* species), which causes bloating and sudden death of cattle if grazed prior to full blooming. Similar reports of feed related problems were reported in other parts of Ethiopian highlands (Lemma 2002; Solomon 2004). This could be due to high protein, low energy, low fiber and low tannin content of the species which initiate foam formation during fermentation of feed in the reticulo-rumen leading to accumulation of gases produced (methane and carbon dioxide) as a result of fermentation of the consumed feed (Lees, 1992; Majak *et al*., 2003).

Table 4: Ranked constraints of livestock production as percived by surveyed households

Agro ecology	Rank	Constraints				
		Feed	Health	Genetic	Labor	Water
High land	1st	55 (91.7)	5 (8.3)	-	-	-
	2nd	5 (8.3)	29 (48.3)	2 (3.3)	23 (38.3)	1(1.7)
	3rd	-	18 (30.0)	12 (20.0)	15 (25.0)	15 (25.0)
	4th	-	8 (13.3)	40 (66.7)	10 (16.7)	2 (3.3)
	5th	-	-	6 (10)	12 (20)	42 (70)
	Index	**0.33**	**0.23**	**0.14**	**0.19**	**0.11**
Mid altitude	1st	106 (70.7)	27 (18.0)	11 (7.3)	2	4 (2.7)
	2nd	30 (20.)	74 (49.3)	6 (4.0)	4 (2.7)	36 (24.0)
	3rd	10 (6.7)	41 (27.33)	46 (30.7)	36 (23.3)	17 (11.3)
	4th	3 (2.0)	5 (3.3)	41 (27.3)	74 (34.0)	27 (18.0)
	5th	1 (0.7)	3 (2.0)	46 (12.7)	34 (25.3)	66 (44.0)
	Index	**0.31**	**0.25**	**0.15**	**0.14**	**0.15**

Feed Resources and Availability

Natural pasture, crop residues, stubble grazing, improved forages and local beverage by-products (*Diqi or atela*) were listed as the major feed resources in both agro ecological areas. But the contribution of improved forages and local beverage by products were minimal. Natural pasture is the major feed resources especially in wet season. However, crop residues and stubble grazing (aftermath grazing) were reported to be the major sources of feed during the dry season. Thus, natural pasture, crop residues and stuble grazing (aftermath grazing) were the major feed resources of the study areas, which consistent with previous reports of Dawit *et al.* (2013) for Adami-Tulu Jiddo-Kombolcha district of East Shewa Zone of Oromia Regional State and that of Adugna (2012) for Ethiopian highlands. The study also identified commonly occurring grass species such as *Pennisetum clandestinum, Eragrostis tenuifolia, Cynodon dactaylon, Digitaria abyssinica, Andropogon abyssinicus, Eulisine jaegeri, Pennisetum sphacelatum, Pennisetum thunbergii* and *Sporobolus pyramidalis*. Similarly, among the legume species *Trifolium rueppellianum, Medicago polymorpha* and wild *Vicia sativm* were reported to be the most common ones.

The study also revealed that the quality of grazing land is deteriorating due to disappearance of better quality and palatable species of grasses, expansion of invasive plants such as *Raphanus raphanistrum* and *Partinium hysterophorus,* and overgrazing and depletion of soil caused by shrinkage of grazing areas as a result of expansion of crop land at the expense of grazing land (Table 5).

Table 5: Cuases for depletion of quality of pasture land as ranked by surveyed households

Possible causes and Agro ecologies	Rank			
	1st	2nd	3rd	Index
High land				
Disappearance of better spp.	50 (83.3)	6 (10.0)	4 (6.7)	0.641
Expansion of invasive plants	4(6.7)	46 (76.7)	10 (16.7)	0.317
Depletion of soil	6 (10.0)	8 (13.3)	46 (76.7)	0.222
Mid high land				
Disappearance of better spp.	75 (50.0)	43 (28.7)	32 (21.3)	0.381
Expansion of invasive plants	48 (32.0)	62 (41.33)	40 (26.7)	0.342
Depletion of soil	27 (18.0)	45 (30.0)	78 (52.0)	0.277

Estimated Annual Feed Balance

Estimated feed DM obtained from private grazing land, crop residue and stubble grazing (aftermath grazing) per surveyed household is shown in Table 6. The amount of feed DM obtained from private grazing lands of surveyed households of highland was significantly higher than ($P<0.01$) that of mid altitude.This could be atributed to larger area of grazing land holding per households of highland than mid-altitude areas, whereas the estimated amount of crop residues produced per household was significantly higher ($P<0.05$) for the mid-altitude than the highland area. This could be due to larger area of maize cultivation that yields larger biomass than other creal crops per hectare (Dirriba *et al*., 2011). But, the estimated feed DM obtained from stubble (aftermath) grazing seems to be similar ($P>0.05$) between the two agro-ecologies.

Table 6: Estimated annual feed DM that can be produced from private holdings per household.

Agro ecology	Estimated annual supply t/hh by source			
	Grass land	Crop Residue	Aftermath	Total
Highland	1.29 ±0.12	8.55±0.67	1.71±0.1	11.55
Mid altitude	0.89±0.07	11.20±0.42	1.81±0.06	13.89
Average	1.00	10.44	1.78	13.22
Significance	**	***	NS	**

Contribution of Major Feed Resources

Figure 1 shows the proportional contribution of major feed resources to the annual feed supply per household. Private grazing land contributes only about 11.17% and 6.41% of annual feed DM per household in highland and mid altitude areas, respectively. On the other hand, the potential contribution of crop residues was the largest contributing about 74 and 81% of the annual feed supply in the highland and mid-altitude area, respectively. After math (stubble) grazing was estimated to be the second largest portion of annual feed supply per households of the two agro ecologies. A similar report in which grazing land, crop residues and after math grazing contributed 11.9, 63.8 and 12.5%, respectively, was reported by Yeshitila (2008) for Alaba district in southern Ethiopia.

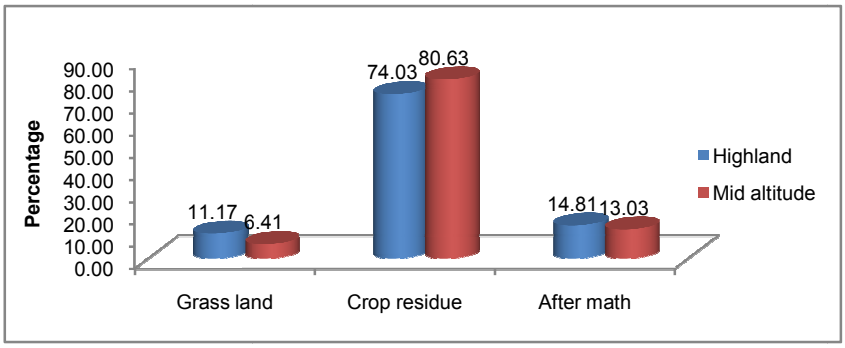

Figure 1: Contribution major feed resources to livestock demand per households

CONCLUSIONS

The study showed that feed shortage, diseases, shortage of labour, low genetic potential of local animals and water scarcity were the major constraints limiting livestock production in both agro ecologies in decreasing order of importance. Overall, the study revealed shortage of feed supply and that the available feed resources are dominated by poor quality crop residues, aftermath grazing and low quality pasture. This is reflected in low growth, production and reproduction performance of animals. The presence of high proportion of clover in the natural pasture causes animal health problem such as bloating when fed wet and at a young age. Thus, the following recommendations are forwarded for improving livestock production in the study areas.

Livestock development programs in the area should address the chronic feed shortage of the study areas through integration of forage production into crop farming system, sustainable conservation, proper storage, processing and proper utilization of available feed resources. The eradication of invasive noxious plants that is invading grass land needs due attention. The problem of bloating as a result of feeding *Trifolium* species at young stage of the plant should be alleviated by adjusting the grazing time, wilting of the forage and overall feeding management.

Conflict of Interest

Conflict of interest none declared.

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