American-Eurasian Journal of Scientific Research 11 (6): 426-436, 2016
ISSN 1818-6785

DOI: 10.5829/idosi.aejsr.2016.426.436

The Status of Livestock Husbandry Practices and Major Production Constraints in the Potential Mixed Farming System Districts of Bale Highlands, Southeast Ethiopia

[1]Girma Defar, [2]Ashenafi Mengistu and [2]Gebreyohanes Berhane

[1]College of Agriculture, Madawalabu University,
P.O. Box 234, Bale-Robe, Ethiopia
[2]College of Veterinary Medicine & Agriculture,
Addis Ababa University, P.O. Box 34, Bishoftu, Ethiopia

Abstract: The study was conducted to assess livestock husbandry practices, feed resources, Reproductive performance and to identify production constraints. Structured questionnaire was employed to collect primary information. Secondary data, field observation and focus group discussions were employed to generate detail data. The study districts households were stratified into better, medium and low wealth groups and a total of 156 respondents (better=40, medium=85 and low=31) were randomly selected and interviewed individually. The study showed that cereal crop dominated crop-livestock farming practiced in the area. The average landholding per household was 5.23±0.19, 4.12±0.29 and 2.19±0.11 for better, medium and low wealth groups, respectively. The average TLU holding was 17.09, 8.83 and 3.87 for better, medium and low group, respectively. Livestock herding activities were distributed to household. The average calving interval ($P<0.05$) and number of calves per life time ($P<0.01$) were significant between better and low wealth group Hhs. All respondents confirmed lack of feed and grazing land as severe constraint, while disease prevalence, labor scarcity, unreliable weather and water shortage are subsequent. Feed sourcing, labor scarcity, poor reproduction performance and disease prevalence were to be focusing areas. Thus, intervention options should aim to lessen the prevailing constraints to crop-livestock farming of different wealth group smallholders in the area for sustainable livelihood of the community.

Key words: Bale highlands · Constraints · Husbandry practice · Livestock · Mixed farming · Wealth group

INTRODUCTION

Mixed farming system provides 50% (meat), 90% (milk) and employs 70% of the world's poor livestock producer [1]. It is an important livestock production system in Ethiopia. In Ethiopia 75% (45 million TLU) of livestock is dwelling in the highlands mixed-farming systems [2, 3]. It covers around 40% of the total land mass of the country and the systems complement each other [4]. Majority of the rural people in Ethiopia's highlands depend heavily on rain-fed subsistence agriculture [5]. Livestock are integrally linked to crop cultivation where crop residues are used to feed livestock while draught power and manure are crucial inputs for crop production [6]. Since long time, farmers have been using their animals for draft power, transportation, source of milk and meat, manure for fuel and fertilizer, saving asset, income generation and grant certain degree of security in times of crop failure [7, 8]. However, low outputs from livestock are a key challenge in subsistence mixed farming areas. The root causes are linked to poor resource availability, husbandry practices, unclear production objectives, genetic potential, institutional linkages and climate factors [9, 10, 39] with the low emphasis given to the sector.

Corresponding Author: Girma Defar, School of Agriculture, Madawalabu University, P.O. Box: 234. Bale-Robe, Ethiopia.

On the other hand, the demand for animal source foods is driven by population growth, urbanization and increased incomes in developing countries [11]. Thus, the scenario needs to look for efficient livestock production that can optimize use of resources, while fulfilling the demand of products for consumers. In similar way Bale highland is one of the potential mixed-farming areas of the country which exclusively practicing crop cultivation and livestock herding with the intermingled and complex problem of the system. For efficient livestock production: the existing husbandry practice, livestock role, available feed resources utilization and production constraints have to be identified. Therefore, the objective of this study was to characterize the status of livestock husbandry practices and to identify major constraints in potential mixed farming areas of Bale highlands, Ethiopia.

MATERIALS AND METHODS

The Study Area: The study was conducted in Bale zone of Oromia National Regional State, Southeast of Ethiopia. The zonal town Robe is located at 430km, from Addis Ababa. The study districts (Sinana, Gasera and Agarfa) were situated at highland area with mean annual rainfall of 1065mm and average daily temperature of 13.8°C (Bale Zone ARDO, NMA Bale branch).

Sampling Procedures: Three potential districts were purposively selected from nine mixed farming districts of Bale zone based on land use, land cover and potential livestock population. Three highland area potential mixed farming Farmer Associations (FAs) randomly selected from each districts. The HHs were stratified into three wealth groups based on asset holding (land and livestock). The HHs were grouped into better wealth (≥4.12hectare land, >15 TLU); Medium wealth (1.84-4.12hectare land, >5 and ≤15 TLU) and low wealth (≤1.84hectare land, ≤5 TLU) asset hold [12; 13; District's Finance and Economic Development Office and local community ranking criteria]. Based on the HHs category, 40, 85 and 31 were better, medium and low wealth groups, respectively those randomly selected for the study. The total sample size (156 HHs) was determined using 4% standard error (SE) according to Arsham [14]. Stratified random sampling technique was used to obtain the sample HHs. A total sample size of 156 HHs; were 25.6% from Better, 54.5% Medium and 19.9% Low wealth groups randomly selected with the help of district agriculture office experts.

Data Collection: A single visit multiple subject formal survey [15] was used for data collection using pre-tested structured questionnaire. Before the interview of the sample HHs, discussion was conducted with key informants of the farming community and districts' agriculture office experts to have an overview of the general livestock production system. The questionnaire was developed using the information generated by key informants. The collected data were socio-economic characteristics of the HH, landholding, cropping pattern, livestock holding, herd composition, purpose of livestock keeping, livestock sheltering, livestock herding labor, feed resources, water sources, reproductive performance, common livestock disease and livestock production constraints. The primary data was collected by enumerators who are working in the study area under close supervision and participation of the principal investigator.

Data Analysis: The data was analyzed using Statistical Packages for Social Sciences (SPSS) software packages of version 20. The analysis included descriptive statistics (means, frequencies and percentages). Indices (weighted averages) developed to obtain the aggregate ranking of the considered parameters.

RESULTS AND DISSCUSSION

Household Characteristics: Mean age of the respondents were 48.49(0.8) years with a mean family size of 6.59(0.2) persons (Table 1). The mean age of respondent, number of productive age and farm experience were significantly different between better and low wealth group HHs. Better wealth group HHs greater age might be due to better living standards, healthcare expenses, better access to basic livelihood necessities and/or due to hired labor. The lowest mean farm experience by low wealth group implies, younger age HHs reside here. The present study overall mean family size is higher than the 5.5 and 5.2 persons per HH reported by CSA [16] for Oromia region and national average, respectively.

Majority of the respondents in the study area attended a primary education as compared to those who were illiterate, basic and secondary education attendants. In agreement, comparable result is reported by Dawit *et al.* [17] in Adami Tullu district. This implies that primary education has addressed to the farming community despite of HHs' wealth difference. Moreover, education is an important factor which if lacking can negatively impact on future advanced livestock production [18].

Table 1: Household socio-economic characteristics and land holding in the study area

	Household wealth group				
Socio-economic characteristics	Better (40) Mean (SE)	Medium (85) Mean (SE)	Low (31) Mean (SE)	Overall (156) Mean (SE)	P value
Households characteristics					
Respondent age (years)	51.83(1.7)[a]	47.79(1.0)[ab]	46.13(2.1)[b]	48.49(0.8)	0.047
Family size	7.48(0.3)[a]	6.41(0.2)[b]	5.94(0.5)[b]	6.59(0.2)	0.004
Productive (15-64) age	4.35(0.3)[a]	3.71(0.2)[ab]	3.23(0.3)[b]	3.78(0.1)	0.013
Unproductive (<15&>64) age	3.13(0.2)	2.71(0.2)	2.71(0.3)	2.81(0.1)	0.33
Farm experience (years)	28.03(1.5)[a]	23.51(0.9)[ab]	22.09(1.7)[b]	24.56(0.7)	0.03
Land holdings					
Grazing land	0.59(0.1)[a]	0.32(0.0)[b]	0.10(0.0)[c]	0.34(0.0)	0.000
Crop land	4.17(0.1)[a]	3.09(0.1)[b]	1.89(0.1)[c]	3.13(0.1)	0.000
Fallow land	0.27(0.1)	0.23(0.0)	0.13(0.0)	0.22(0.0)	0, 097
Improved forage	0.12(0.0)[a]	0.04(0.0)[b]	0.00(0.0)[c]	0.05(0.0)	0.000
Rented* (crop)	0.14(0.1)	0.13 (0.1)	0.06(0.0)	0.12(0.0)	0.730
Rented* (grazing)	0.00(0.0)	0.01(0.0)	0.0(0.0)	0.0(0.0)	0.661
Total land	5.23(0.2)[a]	4.12(0.3)[b]	2.19(0.1)[c]	4.03(0.2)	0.000
Cropland (%) of total land	81.22	84.33	90.66	85.40	---

Means within the same row with different superscripts are significantly different; figures in the bracket are standard errors; *(rented in/out for crop/ grazing)

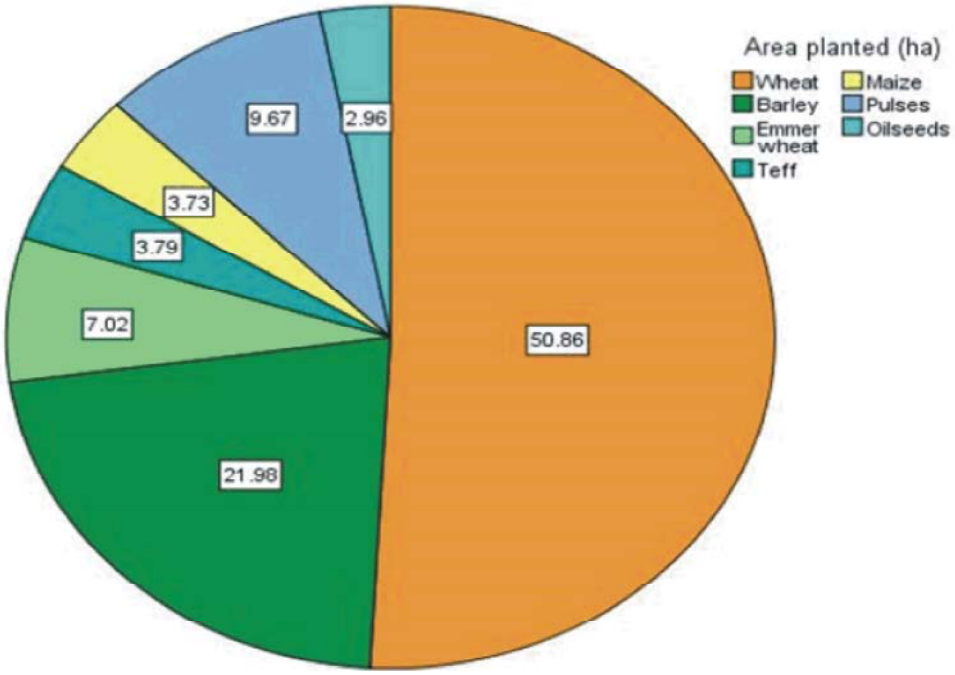

Fig. 1: Land allocation for different crops in the study area

Landholding and Land Use Type: Crop-livestock farming system was dominantly practiced in the study area. There, livestock production is subsistence and important component of the system and well integrated with crop production. In such system livestock are the main source of cash for agricultural inputs purchase [18, 19]. In the area, farmers practice wheat (*Triticum aestivum*) dominated cultivation which is the important crop in the area followed by barley and pulses (field pea and faba bean) (Figure 1).

The average landholding and land uses for different activities are indicated in Table 1. The overall average total landholding of the respondents was 4.03 (0.19) hectares per HH. The mean maximum (5.23) and minimum (2.19) total landholding are owned by better and low wealth group HHs, respectively. The average grazing, crop and improved forage landholding were significantly (P<0.001) between the wealth groups. From the total landholdings, 81.22%, 84.33% and 90.66% (the major portion of the lands) owned by better, medium and low

wealth group HHs, respectively were allocated for crop cultivation. In agreement [18, 17] reported that more land is allocated for cultivation in Dandi and Adami-Tullu districts of Ethiopia. The overall landholding per HH observed is higher than reported by Getachew [20] in Ginchi, Asaminew [21] in Bahir Dar Zuria and Mecha districts of the Blue Nile Basin and Aschalew *et.al.* [41] in Gonder, Ethiopia. These differences could be due to population size and land topography as the present study area is largely plain plateau which is suitable for cultivation. In the current study, unlike the overall landholding differences within wealth HH groups, variations between the districts were not as such apparent.

The pattern of cropping for the study HH of the wealth groups were indicated in Figure 1. Large area of land (50.86%) was allocated for wheat cultivation followed by barley (21.98%) and pulses (9.67%) for all HHs. Wheat was the dominant cultivated crop. This could be due to the availability of wheat technologies such as improved seed, better grain yield per hectare, availability of improved harvesting technologies and other inputs. Moreover, FGD clarified, wheat is considered as one of the cash crop in the study area. The FGD added that crop pattern not only depends on areas of land owned, but on the weather (climate) condition of the cropping season. That is why farmers with large and/or small land area holders seen cropping the same crops despite of their land size.

Livestock Holding and Herd Composition: The total Tropical Livestock Unit (TLU) and herd composition owned are shown in Figure 2. There was a clear difference in cattle and equine holding between the wealth group HHs in the study area. This might be due to more assets owned by senior farming HHs because low wealth HHs found younger (Table 1). A mean of 17.09, 8.83 and 3.87 of total TLU were owned by the better, medium and low HH groups, respectively (Fig. 2). Of the total TLU owned, 85.3% were cattle which were mainly used for draught power and followed by milk production and other interests. This agreed with Belay *et al.* [18] and CSA [16] reports in Ethiopia.

In all wealth groups, livestock are reared for similar purposes where cattle are the most important component of the mixed-farming system serving as source of draught power, milk and meat, income and savings. Similarly, the main purpose of rearing sheep is for immediate cash need, meat and rarely for manure production [40], while equines were kept for transportation of agricultural inputs and products, pulling cart and sometimes riding. In agreement to the present study [19, 22, 23] reported similar results in different parts of the country.

Focus group discussions revealed that when limitations like feed availability, free grazing area and labor are there, more attentions given for cattle than sheep herding. This indicated, farmers are denying the key advantages (early maturity, high prolificacy, thriving on poor feed source, immediate cash source, low foundation cost) of sheep which are crucial in rural community livelihood.

Livestock Herding Labor Sources: Proportion of the family member participated in livestock herding for different HH wealth group of the study area is shown in Table 2. The study found that livestock production was relied on HH members and hired personnel. Herding, watering and tethering activities were more managed by men (14-64 years), boys (≤ 14 years) and hired personnel for both better and medium HH wealth groups while men, women and boys are mostly participated in low wealth group HHs. Milking and barn cleaning are exclusively the activity of women and girls for all HH groups while breeding is the responsibility of men and rarely women. Stall feeding and taking care of sick animals were handled by any HH members labor when they were available.

Labor classification among HH members in herding and other routine activities of the current study agreed with that reported by Freweini [23] in east Hararghe zone of Ethiopia. Hired labor were very important in taking care of livestock herding activities when HHs were in short supply of labor during cropping season and when children attending school. Nowadays, due to shrinkage of free grazing areas and lack of labor in the study area, tethering was commonly practiced except from January to March.

Livestock Housing: Types of house/shelter used for different herd structure in the study area is shown in Table 3. Most commonly, livestock housing was practiced based on species type, sex and age of the animal. Better wealth groups use separate house for (calf, sheep and equines) more frequently ($P<0.000$) than other groups. Whereas low wealth group housed calves and sheep in family house attachment or shade ($P<0.000$) compared to the other wealth groups. Cattle (matured and young) were exclusively housed in open kraals which is consistent with the report of Zewdie [42]. However, FGD revealed that separate houses/shades were used for cattle under

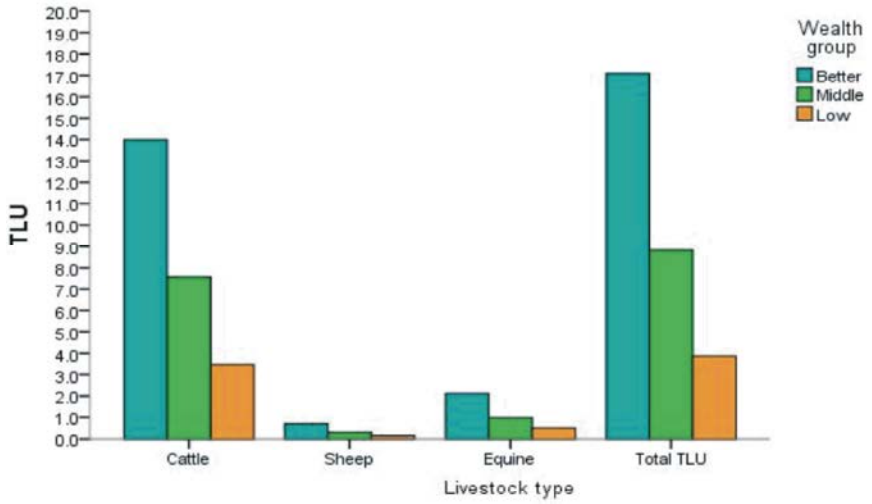

Fig. 2: Household livestock holding and herd composition (TLU) in the study area

Table 2: Livestock keeping labor sources of the household members in the study area (%)

		Livestock keeping routine activities						
Household wealth group	Age and sex group	Herding and watering	Milking	Barn cleaning	Stall feeding	Animal treatment	Breeding	Tether
Better (40)	Girl≤14	3 (12.0)	0 (0.0)	14 (53.8)	6 (24.0)	0 (0.0)	0 (0.0)	1 (3.8)
	Boy≤14	25 (75.8)	0 (0.0)	4 (12.1)	19 (57.6)	6 (18.2)	0 (0.0)	16 (48.5)
	Woman [15-64]	2 (5.0)	39 (100)	40 (100)	19 (48.7)	27 (67.5)	3 (7.7)	8 (20.5)
	Man [15-64]	11 9 (27.5)	1 (2.6)	0 (0.0)	29 (72.5)	34 (85.0)	29 (74.4)	36 (90.0)
	Hired labor	29 (100)	0 (0.0)	1 (10.0)	16 (55.2)	4 (13.8)	2 (6.89)	28 (96.6)
Medium (85)	Girl≤14	12 (21.4)	0 (0.0)	32 (57.1)	13 (23.2)	4 (7.1)	0 (0.0)	1 (1.8)
	Boy≤14	50 (73.5)	0 (0.0)	11 (15.9)	31 (45.6)	5 (7.5)	0 (0.0)	34 (50.0)
	Woman [15-64]	13 (15.3)	82 (97.6)	85 (100)	52 (61.2)	68 (81.0)	7 (8.3)	32 (37.6)
	Man [15-64]	61 (72.6)	7 (8.8)	0 (0.0)	65 (80.2)	64 (80.0)	27 (35.0)	73 (90.1)
	Hired labor	29 (100)	1(3.4)	0 (0.0)	18 (62.1)	1 (3.4)	0 (0.0)	27 (93.1)
Low (31)	Girl≤14	4 (17.4)	2 (11.8)	13 (56.5)	5 (21.7)	3 (13.0)	0 (0.0)	2 (8.7)
	Boy≤14	16 (76.2)	0 (0.0)	2 (9.5)	10 (47.6)	1 (4.8)	0 (0.0)	9 (42.9)
	Woman [15-64]	11 (35.5)	24 (96.0)	31 (100)	17 (54.8)	20 (64.5)	1 (3.8)	19 (61.3)
	Man [15-64]	26 (89.7)	1 (4.3)	0 (0.0)	21 (70.0)	21 (70.0)	1 (3.8)	29 (96.7)
	Hired labor	3 (100)	0 (0.0)	1 (33.3)	0 (0.0)	0 (0.0)	0 (0.0)	2 (66.7)

Numbers outside and inside parenthesis represents respondent number and percentage, respectively

Table 3: Frequency (%) of livestock housing type used in the study area

	Household wealth groups				
Description of variables	Better (40)	Medium (85)	Low (31)	Overall (156)	P value
Cattle (matured & young)					---
Open corral	100	100	100	100	
Family house attachment/partitions	0	0	0	0	
Separate house/shade	0	0	0	0	
Calf					0.000
Open corral	0	0	0	0	
Family house attachment/partitions	37.5	56.5	90.3	58.3	
Separate house/shade	62.5	43.5	9.7	41.7	
Sheep					0.343
Open corral	0	0	0	0	
Family house attachment/partitions	38.5	45.9	66.7	45.8	
Separate house/shade	61.5	54.1	33.3	54.2	
Equine					0.255
Open corral	45.0	55.3	64.5	54.5	
Family house attachment/partitions	0	0	0	0	
Separate house/shade	55.0	44.7	35.5	45.5	

special conditions (health case and at early parturition during bad weather). Housing of sheep in attachments to family house and separate houses were more consistent with all wealth groups. This is to secure their animals from predator, theft and bad weather conditions as they were easily affected by external factors. Poor housing that fails to protect animals from environmental factors might be one means of low production performance.

Feed Sources: The feed sources in the study area were composed of communal, private and aftermath, crop residue, improved forage and homemade concentrate (HMC) with some opportunistic feeds (weeds). The current findings agreed with the feed sources reported in most highlands of Ethiopia [24, 42] with some differences in availability (quantity and/or quality) and crop types grown. Generally, natural pasture and crop residues were the dominant feed sources in the study area. During dry season crop aftermath and crop residues were the most available feed sources for all wealth HH groups. The result confirmed that crop residues (cereals and pulses), crop aftermath and natural grasses (communal, private and fallow lands) dry matter yield (DMY) production contributed 72.59%, 14.41% and 9.12% DMY to the total diet, respectively (Table 4). The overall roughage feed contributed 96.12% of the total feed produced. In the study area crop residues (basically cereals) were fed to animals throughout the year with some supplement feeds when they were available and the situation is similar with the study by [41] in Gonder.

In lined with the current study, [25] reported that in wheat based crop-livestock production system of Ethiopian highlands, the contribution of crop residues and crop aftermath grazing account for 70 % of the total feed supply, while native pasture accounts for 30%. However, there is a controversy that whether the DMY from all available crops residue is efficiently utilized. Farmers in the study area were claiming the palatability of wheat straw as compared to barely and other residues. Moreover, the availability of crop aftermath for grazing during August was very scarce because of the subsequent plantation of the same land by other crop. In contrary to the present study, [26] reported that dry season major feed sources for cattle in Metema district of Ethiopia is natural pasture (55.7 %). Additionally, [27] in Uganda and Luke [28] in Kenya reported pasture contributes the largest proportion of the feed sources on DM basis.

The FGD revealed that most of the farmers used natural pasture from communal, cropland border and roadside for grazing followed by crop residues at different level of utilization despite differences in the wealth groups. Communal grazing includes wetlands, river side, raggedy areas and state farms which were all marginalized for cultivation due to different factors. Most of the time, the communal grazing areas were used by all HHs during off-season and the rest months by HHs whose land adjoining it. Improved forages and HMCs were fed to oxen, lactating cows, calves, sick animal and equines (pulling cart) in small amount by setting priority for the importance of these animals because of feed shortage.

Livestock Drinking Water Sources: Table 5 illustrates the major sources of water for livestock drinking in dry and wet season in the study area. The result showed that river, pond and spring were relatively major sources of drinking water for livestock throughout the year. The current finding regarding sources of water for livestock in the two seasons were comparable with the finding of Ayele [30] and Zewdie [31] in the highlands of Blue Nile Basin and Debre-Birhan areas of Ethiopia, respectively. The FGD suggested that quality of water and the distance of watering points were the major concerns particularly in prolonged dry season for all wealth groups. Similar observations were reported by Descheemaeker *et al*. [32] in the Blue Nile Basin of Ethiopia.

In the current study, watering frequency varied between seasons for all wealth groups with the availability and proximity of water sources. In dry season, even though animal's need frequent watering per day, it was difficult to water them more than one, while once in two days was common when some of the sources dried out and alternative water sources were very far. Similar finding is reported in Botswana [44]. This indicates seasonal water availability and watering frequency have an implication on water requirement of different livestock classes. In agreement with the current findings [30] also reported similar investigation in Blue Nile Basin highlands of Amhara Region, Ethiopia. In contrary to the present and other similar studies elsewhere [33] reported, about 52% (majority) of the respondent watering their animals twice a day in central highlands of Ethiopia. This indicates how the weather condition of a specific area influences the watering frequency of livestock.

Table 4: Major feed resources and annual dry matter yield of the wealth groups

	Household wealth groups							
	Better (40)		Medium (85)		Low (31)		Overall (156)	
Feed sources	DMY** (ton)	% of total	DMY (ton)	% of total	DMY (ton)	% of total	DMY (ton)	% of total
Communal grazing land *	0.14	0.75	0.14	1.05	0.14	1.69	0.14	1.05
Private grazing land	1.20	6.47	0.62	4.64	0.26	3.13	0.69	5.15
Fallow land	0.48	2.59	0.42	3.15	0.26	3.13	0.39	2.92
Cereal residue	12.10	65.26	9.33	69.89	5.85	70.57	9.09	67.88
Pulse residue	0.80	4.31	0.67	5.02	0.41	4.96	0.63	4.71
Crop aftermath	2.71	14.62	1.78	13.33	1.3	15.68	1.93	14.41
Total Roughage (DM) [a]	17.43	94.01	12.96	97.08	8.22	99.16	12.87	96.12
Improved forage [b]	0.96	5.18	0.34	2.55	0.06	0.72	0.45	3.36
Homemade feeds (HMC) [c]	0.15	0.81	0.05	0.37	0.01	0.12	0.07	0.52
Total feed (a + b + c) DM	18.54	100.00	13.35	100.00	8.29	100.0	13.39	100.0

* = fragile uncultivable small areas; ** = DMY estimation is on the basis of FAO, [29]

Table 5: Frequency (%) of livestock drinking water sources share of dry and wet season in the study area

	Season of water availability							
	Dry season				Wet season			
	Household wealth group				Household wealth group			
Water sources	Better (40)	Medium (85)	Low (31)	Overall (156)	Better (40)	Medium (85)	Low (31)	Overall (156)
River	32 (80.0)	69 (81.2)	22 (71.0)	123 (78.8)	38 (95.0)	84 (98.8)	30 (96.8)	152 (97.4)
Pond	11 (27.7)	12 (14.1)	6 (19.4)	29 (18.6)	15 (37.5)	30 (35.3)	8 (25.8)	53 (34.0)
Hand dug well	18 (45.0)	50 (58.6)	14 (45.2)	82 (52.6)	3 (7.5)	9 (10.6)	1 (3.2)	13 (8.3)
Spring	19 (47.5)	36 (42.4)	16 (51.6)	71 (45.5)	22 (55.0)	37 (43.5)	10 (32.3)	69 (44.2)
Tap water	14 (35.0)	31 (36.5)	5 (16.1)	50 (32.1)	11 (27.5)	14 (16.5)	4 (12.9)	29 (18.6)

Numbers outside and inside parenthesis represents respondent number and percentage, respectively

Table 6: Livestock reproductive parameters condition in the study area

		Household wealth group				
		Better (40)	Medium (85)	Low (31)	Overall (156)	
Livestock type	Reproductive parameters	Mean(SE)	Mean(SE)	Mean(SE)	Mean(SE)	P value
Cattle	Age at sexual maturity (years)	3.79(0.05)	3.77(0.04)	3.789(0.08)	3.77(0.03)	0.936
	Age at 1st calving (years)	4.81(0.05)	4.77(0.04)	4.78(0.08)	4.78(0.03)	0.855
	Calving interval (years)	2.26(0.05)[b]	2.44(0.04)[a]	2.46(0.08)[a]	2.39(0.03)	0.025
	Number of calves per life time	5.35(0.15)[a]	4.91(0.09)[a]	4.72(0.18)[b]	5.00(0.07)	0.010
Sheep	Age at sexual maturity (years)	1.07(0.04)	1.04(0.02)	1.11(0.07)	1.06(0.02)	0.506
	Age at 1st lambing (years)	1.64(0.04)	1.64(0.04)	1.64(0.07)	1.64(0.02)	0.993
	Lambing interval (years)	0.82(0.02)	0.77(0.02)	0.77(0.03)	0.78(0.01)	0.362
	Number of lambs per life time	10.50(0.39)	10.39(0.33)	10.77(0.07)	10.48(0.24)	0.869
Equine	Age at sexual maturity (years)	3.17(0.05)[b]	3.33(0.06)[a]	3.75(0.25)[a]	3.26(0.04)	0.030
	Age at 1st birth giving (years)	4.17(0.05)[b]	4.33(0.07)[a]	4.75(0.25)[a]	4.26(0.04)	0.036
	foaling interval (years)	2.19(0.06)	2.13(0.05)	2.25(0.25)	2.16(0.03)	0.605
	Number of foals per life time	6.51(0.21)	6.11(0.15)	5.50(0.5)	6.28(0.13)	0.188

Means within the same row with different superscripts are significantly different, figures outside and inside the parenthesis indicate the mean and SE, respectively

Reproductive Performance: Reproductive performance parameters of the present study are listed in Table 6. The overall mean age at sexual maturity, age at 1st calving, calving interval and number of calves per life time for cattle were 3.77(0.03), 4.78(0.03), 2.39(0.03) years and 5.0 (0.07) heads, respectively. Similarly, these parameters were indicated for sheep and equine (donkey). In the present study, age at first calving of cattle was comparable with 46.06(13.99) months reported by [34], 50.59(6.94) months by Belay *et al*. [18] and 59.9 months by [43] for indigenous cows.

Table 7: Rank of the major constraints associated with livestock production in the study area

		Scores of the problems							
Household wealth group	Major problems	1st	2nd	3rd	4th	5th	6th	Index	Rank
Better (40)	Feed & grazing land shortage	25	20	7	2	2	0	0.407	1
	Low output	0	2	8	9	5	10	0.126	4
	Disease prevalence	1	4	4	8	12	8	0.139	3
	Labor scarcity	1	3	11	6	6	6	0.143	2
	Water scarcity	1	4	3	1	3	1	0.064	6
	Unreliable weather	3	0	2	12	10	4	0.122	5
Medium (85)	Feed & grazing land shortage	57	46	19	4	0	0	0.431	1
	Low output	0	2	12	28	21	13	0.129	3
	Disease prevalence	1	5	11	19	29	7	0.129	3
	Labor scarcity	6	5	25	10	11	16	0.149	2
	Water scarcity	1	3	7	6	1	4	0.048	6
	Unreliable weather	4	3	6	19	18	19	0.114	5
Low (31)	Feed & grazing land shortage	26	23	3	0	0	0	0.496	1
	Low output	0	2	4	11	2	7	0.123	3
	Disease prevalence	0	1	8	8	9	0	0.139	2
	Labor scarcity	0	2	6	4	7	7	0.117	4
	Water scarcity	0	0	5	1	0	2	0.044	6
	Unreliable weather	0	0	3	6	12	4	0.081	5

As shown in the table, the average calving interval showed significant ($P<0.05$) difference between the better and other wealth groups. Similarly, the average number of calves per life time showed a significant difference ($P<0.01$) for better wealth group. The average age at sexual maturity and average age at 1st foaling of equines were significant ($P<0.05$) between better and the rest wealth groups (Table 6). The differences might be credited to feed availability, availability of breeding males, animal health care and other routine management practices.

Livestock Production Constraints: The major constraints which predominantly influenced livestock production of all wealth groups were feed and grazing land shortage (1st rank). The remaining problems ranked 2nd to 6th ranks according to their economic importance (Table 7). Farmers said that, they were fallowing their lands for grazing purpose as a solution for feed scarcity even if they need the land for cropping. The finding agreed with the work of [34] on smallholder cattle production systems in Metekel, Northeast Ethiopia. In the present study, even though the better HH groups owned more land (Table 1), feed and grazing land shortage were ranked as a priority constraint (Table 7). The reason was that they owned relatively more number of TLUs as compared to other wealth group HHs and more land were allocated to crop production. Unreliable weather condition was ranked 5th for all HH groups which implies that most of the respondents had similar awareness level or understanding even though, the rank was not sound in relation to changing climate. This might be due to the knowledge gap of smallholder farmers' future expectation to the attributes of climate changes could affect the agricultural sector during these days.

In the study area, different type of diseases were economically important livestock diseases of animals of the same species for all wealth group HHs even though there were difference in control mechanism and level of medication. The FGD also strengthen the individual HHs face to face interview. The farmers mentioned viral and bacterial diseases were affecting all livestock species of the HHs despite the differences in wealth status. The FGD confirmed that these diseases are mostly occur when environmental conditions are favorable and the body condition of animals is poor due to inadequate feed availability during the preceding dry periods. These diseases were also reported important by Solomon [35] and Zewdie [31] and Yami *et al*. [36] in Sinana district, Ziway area and highlands of Arsi zone Ethiopia, respectively. From the focus group discussions, it was observed that the accessibility of animal healthcare services were similar problems for all wealth group HHs.

In the study area, constraints to smallholder livestock producers were principally caused by man-made factors. These factors were interrelated and associated with population growth, cropland expansion, land degradation and overgrazing. In line with the current findings [37, 39] and Fetsum *et al.* [38] reported similar results under similar farming system elsewhere areas of Ethiopia.

CONCLUSSIONS

Livestock particularly cattle and equine play a significant role in the livelihood of mixed-farming smallholders of Bale zone highland areas. Low wealth group HHs hold relatively low assets. This HH group obtained less benefit from their asset because of poor output of the land and livestock compared to farmers elsewhere in Ethiopia. Small ruminant (sheep) herding as part of livestock composition was limited to availability of herding labor and/or free grazing area accessibility by wealth HH groups. In general, improper livestock husbandry practices were the major reason for low output of animals beside the feed problem (quality vs quantity) mainly caused by grazing land shrinkage in the area. The other major constraints include labor scarcity, disease prevalence and water shortage during dry season. All the mentioned factors together resulted in low level of productivity and decreased the benefit of the farmers from livestock. The other major constraints include labor scarcity, disease prevalence and water shortage during dry season. All the mentioned factors together resulted in low level of productivity and decreased the benefit of the farmers from livestock. To alleviate the existing constraints and bring a sustainable livelihood of crop-livestock mixed farming smallholders, intervention options need to base wealth group differences of the production system and identify and prioritize constraints in the study area.

ACKNOWLEDGMENTS

The authors thank Addis Ababa University for research grant offered. The authors are also grateful to thank the zonal and districts' agriculture office experts, enumerators, respondent farmers, friends and colleagues for their cooperation.

REFERENCES

1. Thornton, P. and M. Herrero, 2001. Integrated crop-livestock simulation models for scenario analysis and impact assessment. In: Proceedings of Third International Symposium on Systems Approaches for Agricultural Development, Lima, Peru, 8-10 November 1999.
2. Deressa, T.T., R.M. Hassan and C. Ringler, 2008. Measuring Ethiopian farmers' vulnerability to climate change across regional states, IFPRI discussion paper No. 806. http://www.ifpri.org/pubs/dp/.
3. CRGE (Ethiopia's Climate-Resilient Green Economy), 2011. Green economy strategy, Federal Democratic Republic of Ethiopia, Addis Ababa, November 2011.
4. World Bank, 2011. Climate-Smart Agriculture: Increased Productivity and Food Security, Enhanced Resilience and Reduced Carbon Emissions for Sustainable Development. Opportunities and Challenges for a Converging Agenda: Country Examples, October, 2011.
5. Bewket, A., 2010. Analysis of Farmers' Perception and Adaptation to Climate Change and Variability: The Case of Choke Mountain, East Gojjam. MSc thesis, Addis Ababa University.
6. Thornton, P., M. Herrero and P. Ericksen, 2011. Livestock and climate change: 'Better lives through livestock'. Livestock Exchange Issue Brief 3. www.ilri.org
7. Gizaw, S., A. Tegegne, B. Gebremedhin and D. Hoekstra, 2010. Sheep and goat production and marketing systems in Ethiopia: Characteristics and strategies for improvement. IPMS of Ethiopian Farmers Project Working Paper 23. Nairobi, Kenya: ILRI.
8. Brighter Green, 2011. Climate, Food security, & Growth: Ethiopia's Complex relationship with livestock. www.brightergreen.org, accessed Jan. 14, 2014.
9. Ayele, Z. and C. Peacock, 2003. Improving access to and consumption of animal source foods in rural households: The experiences of a women-focused goat development program in the highlands of Ethiopia. Journal of Nutrition, 133(11): 3981-3986.
10. Mohammed, M., E. Simeon and A. Yemesrach, 2004. Dairy Development in Ethiopia International Food Policy Research Institute 2033 K Street, NW, Washington, DC 20006 U.S.A.
11. IGAD (Intergovernmental Authority on Development), 2011. The contribution of livestock Ethiopian to economy Part II. IGAD Livestock Policy Initiative working paper No. 02-11.
12. Assefa, A., 2005. Farm Management in Mixed Crop-livestock Systems in the Northern Highlands of Ethiopia. Doctoral thesis, Plant Production Systems Group, Wageningen University, Wageningen, The Netherlands.
13. Salami, A., Kamara, B. Abdul, Brixiova and Zuzana, 2010.Smallholder Agriculture in East Africa: Trends, Constraints and Opportunities, Working Papers Series No. 105 African Development Bank, Tunis, Tunisia.

14. Arsham, H., 2005. Questionnaire design and surveys sampling, 9th ed.
15. ILCA, 1990. Livestock Systems Research Manual. Working Paper 1, Vol, 1, International Livestock Center for Africa (ILCA). Addis Ababa, Ethiopia.
16. CSA, 2013. Ethiopian Rural Socioeconomic Survey (ERSS). Central Statistical Agency (CSA) and the World Bank, Addis Ababa Ethiopia.
17. Dawit, A., N. Ajebu and B. Sandip, 2013. Assessment of feed resource availability and livestock production constraints in selected kebeles of Adami-Tullu Jiddo-Kombolcha District, Ethiopia. Afr. J. Agric. Res., 8(29): 4067-4073.
18. Belay, D., T. Azage and B.P. Hegde, 2012a. Smallholder Livestock Production System in Dandi District, Oromia Regional State, Central Ethiopia. Global Veterinaria, 8(5): 472-479.
19. Malede, B. and A. Takele, 2014. Livestock Feed Resources Assessment, Constraints & Improvement Strategies in Ethiopia. Middle-East Journal of Scientific Research, 21(4): 616-622.
20. Getachew, E., 2002. An assessment of feed resources, their management and impact on livestock productivity in the Ginchi watershed Area. M.Sc. Thesis. Alemaya University, Alemaya, pp: 172.
21. Asaminew, T., 2007. Production, handling, traditional processing practices and quality of milk in Bahir-Dar milk shed area, Ethiopia. M.Sc. Thesis. Alemaya University, Alemaya, pp: 130.
22. Yeheyis, L., C. Kijora, S. Melaku, A. Girma and K.J. Peters, 2010. White lupin (*Lupinusalbus L.*), the neglected multipurpose crop: Its production and utilization in the mixed crop-livestock farming system of Ethiopia. Livestock Research for Rural Development, 22: (74). http://www.lrrd.org/lrrd22/4/yehe22074.
23. Freweini, A.T., 2014. Assessment of the feeding potential and utilization of *Erythrinaburana* and *Casimiroaedulis* in Eastern Hararghe zone of Ethiopia. Livestock Research for Rural Development, 26(5).
24. Tolera, A., A. Yami and D. Alemu, 2012. Livestock feed resources in Ethiopia: Challenges, Opportunities and the need for transformation. Ethiopia Animal Feed Industry Association, Addis Ababa, Ethiopia.
25. Seyoum, B., A. Getnet, T. Abate and F. Dereje, 2001. Present status and future direction in feed resources and nutrition research targeted for wheat based crop livestock production system in Ethiopia, pp: 207-226. In: P.C. Wall (ed.). Wheat and Weed: Food and Feed. Proceedings of two-stakeholder workshop. CYMMYT, Mexico City. Improving the productivity of crop livestock production in wheat based farming systems in Ethiopia, Addis Ababa. 10-11 October 2000.
26. Tesfaye, D., 2008. Assessment of feed resources and rangeland Condition in Metema district of north Gondar zone, Ethiopia. An MSc. thesis submitted to the department of Animal sciences, school of graduate studies Haramaya University.
27. Ben, L., K. Jane, W. Ronald and B. Isabelle, 2010. Characterization of the livestock production system and potential for enhancing productivity through improved feeding in Bbaale, Uganda.
28. Luke, Y., 2010. Characterization of the livestock production system and potential for enhancing productivity through improved feeding in Ol-Kalaou division, Kieni West district, Kenya.
29. FAO, 1987. Land use, production regions and farming systems inventory. Technical report 3 vol. 1. FAO project ETH/78/003, Addis Ababa, Ethiopia.
30. Ayele, A., 2012. Small-holder farms livestock management practices and their implications on livestock water productivity in mixed crop-livestock systems in the highlands of Blue Nile basin: A case study from Fogera, Diga and Jeldu districts (Ethiopia). MSc. Thesis Submitted to the Department of Animal and Range Sciences. Hawasa University, College of Agriculture.
31. Zewdie, W., 2010. Livestock production systems in relation with feed availability in the highlands and central rift valley of Ethiopia MSc. thesis, Haramaya University.
32. Descheemaeker, K., A. Tilahun and H. Amare, 2009. Livestock and Water Interactions in Mixed Crop-Livestock Farming Systems of Sub-Saharan Africa: Interventions for Improved Productivity. Colombo, Sir Lanka: International Water Management Institute, pp: 44. IWMI Working Paper 133.
33. Endale, Y., E. Abule, F. Lemmaand A. Getnet, 2016. Livestock feed production and feed balance in Meta-Robi District, West Shewa Zone, Oromiya Regional State, Ethiopia. Academic Research Journal of Agricultural Science and Research, 4(2): 45-54.
34. Solomon, Z., K. Binyam, A. Bilatu, A. Ferede and M. Gadisa, 2014. Smallholder cattle production systems in Metekel zone, northwest Ethiopia. Research Journal of Agriculture and Environmental Management, 3(2): 151-157. http://www.apexjournal.org.

35. Solomon, B., 2004. Assessment of Livestock Production Systems Feed Resource base in Sinana Dinsho district of Bale highlands, Southeast Oromiya, An MSc. Thesis, Alemaya University, Dire Dawa, Ethiopia.
36. Yami, M., B. Bedada and T. Teklemedihin, 2013. Enhancing the productivity of livestock production in highland of Ethiopia: Implication for improved on-farm feeding strategies and utilization. African Journal of Water Conservation and Sustainability, 1(1): pp. 015-029, www.internationalscholarsjournals.org.
37. Agza, B., K. Binyam, Z. Solomon, A. Eskinder and A. Ferede, 2013. Forage yield and nutritive value of natural pastures at varying levels of maturity in North West Lowlands of Ethiopia. World J. Agric. Sci., 1(3): 106-112.
38. Fetsum, S.Z. Solomon, D. Mikias, S. Yigremachew, M. Demeke, W. Gizachewand C. Yeshi, 2009. Gender Based Participatory Rural Appraisal of Farming Systems in Wombera, Bullen and Guba Woredas. In Gender Differentials for Planning Agricultural Research. Proc. of the Workshop on Gender Analysis in Agricultural Research. Addis Ababa, Ethiopia, pp: 161-187.
39. Samuel, M., 2014. Livestock Production Constrains Priorities and its Determinant Factors in Mixed Farming System of Southern Ethiopia. World J. Agric. Sci., 10(4): 169-177.
40. Belay, Duguma, Dhaba, U., D. Solomon and T. Taye, 2012. Sheep and Goat Production Systems in Ilu Abba Bora Zone of Oromia Regional State, Ethiopia: Feeding and Management Strategies. Global Veterinaria, 9(4): 421-429.
41. Aschalew, A., B. Malede, D. Yalew and A. Shewangzaw, 2014. Non-Conventional Feed Resources and Their Utilization Practice in North Gondar, North West Ethiopia. Acad. J. Nutr., 3(3): 26-29.
42. Zewdie Wondatir, 2015. Assessment of Livestock Production and Feed Resources Availability at Melka Watershed of Nile Basin, Jeldu District, Ethiopia. World Appl. Sci. J., 33(12): 1892-1902.
43. Damitie, K., A. Kefyalew and G. Endalkachew, 2015. Reproductive and Productive Performance of Fogera Cattle in Lake Tana Watershed, North Western Amhara, Ethiopia. J. Reprod. & Infertility, 6(2): 56-62.
44. Sennye, M. and U. Peter, 2009. The Projected Cost of Climate Change to Livestock Water Supply and Implications in Kgatleng District, Botswana. World J. Agric. Sci., 5(5): 597-603.