



# World Scientific News

WSN 53(3) (2016) 178-188

EISSN 2392-2192

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## **Smallholder Cattle Production Systems and Husbandry Management in West Shewa Zone of Oromia Regional State, Central Ethiopia**

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### **ABSTRACT**

The study was conducted in West Shoa zone, Oromia, central Ethiopia, aimed with assessment of Production Systems and Husbandry Management of dairy cattle. The study area covered 180 households found in peri-urban, urban and rural areas of Adaberga, Ejere and Metarobi districts which included 58 in rural areas, 101 in peri-urban and 21 in urban areas of the districts. The information was collected from secondary data, group discussion, household level survey questionnaire, farm visit and personal observations. The data were analyzed using SPSS (version 20). The farming system of the study area was grouped into livestock production (12.78%), crop production (2.78%) and mixed type of production (84.46%). Average land holding for crop, grazing and forage and irrigated land in the study areas were 2.3 ha, 1.38 ha and 0.17 ha respectively. About 100% in rural, 33.55% in peri-urban and 0.65% in urban of households, who owned local dairy cows, were used free grazing and fed crop residue as supplement. Similarly 22.58% of households in urban and peri-urban, who had both local and crossed dairy cows, were used free grazing system for local and industrial by products for crossed cow with crop residue. The remaining 6.45% of household in urban and 9.03% in peri-urban were used stall feeding of industrial by products with the mix of crop residue and atella. Water for drinking dairy cattle were accessed from pond (12.26%), rivers (61.9%), pipe water (23.29%) and stream (2.58%). From total respondents about 87.1% and 11.6% of respondents were cleaned dairy barns in daily and weekly basis respectively whereas 1.29% of the respondents were not cleaned dairy barns all the time. The dairy production improvements must consider the available feed resources, farming system, socio-economic and husbandry management.

**Keywords:** Dairy Cattle; Production System; Peri-urban; Rural; Urban

## **1. INTRODUCTION**

Ethiopia is believed to have the largest livestock population in Africa. This livestock sector has been contributing considerable portion to the economy of the country and still promising to rally round the economic development of the country. Livestock husbandry plays an important role in agricultural development in Ethiopia, which is the backbone of the economy. Livestock are source of income, milk, meat, hides, skins, manure and also a means of employment. In addition, oxen are used for traction power in traditional farming systems, indicating close interdependence of crop and livestock production systems. Crop-livestock interaction farming systems have been viewed as the poverty saving net for resource-poor rural farmers in the developing countries where the farmers are generally poor .

The total cattle population for the country was estimated about 53.99 million [1], of which the traditional production systems which mainly rely on indigenous cattle (>99%) are the major source of milk supply in Ethiopia [2,3]. Livestock support and sustain livelihoods for 80% of the rural community of Ethiopia. The estimated numbers of indigenous milk cows in Ethiopia is about nine million and in the hands of smallholder farmers under traditional production system. The total milk production per year from cattle was 0.8 million out of 1.0 million tons from all the species put together in Ethiopia [4].

Cattle production is the most important livestock sub-sector in West Shoa zone and meets the multiple objectives that are desired by smallholder farmers providing draught power, milk, meat, manure and source of household income among other socio-economic importance. Even if the West Shoa Zone has high cattle potential, so far there is little baseline information on cattle production systems and management characteristics. In addition Farmer's knowledge and husbandry management are highly associated with production systems that they practice. In order to plan and implement cattle development strategies in the study area,

It is essential to know details about the overall production and management systems of cattle. Thus the study was undertaken with the aim to assess the cattle production system and husbandry practice in three different districts of West Shoa Zone:

- To outline general production system of farmers in the study area;
- To characterize husbandry management of farmers for dairy cattle in the study area

## **2. MATERIALS AND METHODS**

### **2. 1. Description of Study Area**

The study was conducted in three districts of West Shoa zone of Oromia region, Ethiopia (Adaberga, Ejere and Metarobi). The West Shoa Zone is one of the 18 zones in Oromia National Regional State which is 111 km far away from Addis Ababa.

The altitude of the zone ranges from 1166 to 3238 meters above sea level (masl), where the largest area lies between 2300 and 2630 m.a.s.l. The topography of the zone, which is mainly leveled field, makes it an ideal place for agriculture. Temperature ranges from 11-21 °C and rainfall from 880-1200 mm [5].

## **2. 2. Sampling Methods and Data Collection**

The preliminary information of the study area and farmers were taken from the report of zonal consultation meeting and rapid assessment of the selected sites which was held by Livestock and Irrigation Value chain for Ethiopians Smallholders (LIVES) Project. Secondary information from Districts and Zonal Agricultural and Rural Development offices was also utilized to assist in the selection of district kebeles.

Based on their milking shed potentiality and dairy production availability, three districts from West Shewa and three kebeles from each district were purposively selected for questionnaire administration. Simple random sampling technique was used for farmer selection in kebeles. A total of 180 households (60 from each district) were randomly selected from the dairy holding households for the interview from the selected kebeles. Total sample size was calculated using the following formula [6].

$$\text{Total sample } (N) = \frac{Z\alpha^2 \times p(1 - p)}{d^2}$$

where:

N = required sample size

p (expected proportion) = 0.135 (if the population is homogenous)

d (desired absolute precision) = 0.05

$Z\alpha = 1.96$  (is the abscissa of a normal curve that cuts of an area at the tails ( $1-\alpha$  equals to the desired confidence level, for 95% = 1.96)

The required sample size of the respondent with 95% confidence level was calculated as,

$$\begin{aligned} N &= Z\alpha^2 \times p \\ (1-p)/d^2 &= [(1.96)^2 \times 0.135(1-0.135)] / (0.05 \times 0.05) \\ 3.8416 \times 0.1168 / 0.0025 &= 180 \text{ farmers} \end{aligned}$$

## **2. 3. Questionnaire administration**

Data was collected from primary sources. A semi- structured Questionnaire was prepared and pre-test before administration and some re-arrangement, reframing and correcting in accordance with respondent perception was done. A pertinent questionnaire to the respective respondents for selected smallholder households in the study area was administered. The questionnaire was filled by trained enumerators recruited for the purpose with close supervision by the researcher. During the interview process, every respondent included in the study was briefed about the objective of the study before starting presenting the actual questions.

The information related to socio-economic characteristics of the farmers, production system and husbandry management (housing system cleaning feeding resource), feed situation were assessed from recall survey. Focus group and key informants' discussion were also conducted to strengthen the data obtained from structured and semi-structured questionnaire. The group was formed with 15 farmers and composed of youngsters, women, village leaders and socially respected individuals.

## 2. 4. Methods of Data Analysis

All the data were fed to Ms-Excel 2007. Qualitative data survey was analyzed for descriptive statistics using frequency procedure and cross tabulation of SPSS version 20. Similarly for quantitative data obtained from the recall survey one way ANOVA of SPSS version 20 was used to evaluate the effect of production system in livestock holding of farmers.

## 3. RESULT AND DISCUSSION

### 3. 1. Household Member and Educational Level of Household Heads

The results on gender proportion of respondents were presented in Table 1. On average, the majority (80.6%) of the total respondents were male headed households and the rest 19.4% were female headed households. Urban farmers had more household female headed than per-urban and rural farmers. This is in agreement with the report of [7] for the case of central highlands. The dominance of male household heads reported here is in agreement with results published by [8] for Hawassa, Ethiopia.

The results on educational level of respondents were presented in Table 2. The result showed that proportion of illiterate household heads was estimated as (42.5%, 47.7%, 25%) and (75%, 76.92%, 0%) for rural and per-urban and urban for male and female household heads, respectively. Male headed household were higher in proportion of educational level as compared to female headed household heads in all rural, per-urban and urban areas. This study is consistent with the result of [9]. It could be argued that, educated households tend to use modern method of rearing like milk production through good management.

**Table 1.** Gender Proportion of Household in the study area

Urban level	N	Male	Female
Rural (%)	58	87.9	12.1
Per-urban (%)	101	81	19
Urban (%)	21	76.2	23.8
Total (%)	180	80.6	19.4

**Table 2.** Educational level of respondents

Education level	male						Female						Total			
	rural		urban		Peri-urban		rural		urban		Peri-urban		Male		Female	
	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%
<b>Illiterate</b>	23	42.59	5	25	42	47.73	3	75	-	-	10	76.92	70	43.23	13	72.22

1-7	20	37.04	5	25	31	35.23	1	25	-	-	2	15.38	56	34.57	3	16.67
8-12	6	11.11	5	25	7	8	-	-	-	-	1	7.69	18	11.11	1	5.56
>12	5	9.26	5	25	8	9.10	-	-	1	100	-	-	18	11.11	1	5.56
Total	54	100	20	100	88	100	4	100	1	100	13	100	162	100	18	100

### 3. 2. Household Resource

The land holding of the respondents of study area was presented in Table 3. Average land holding for crop was 2.3 ha. Out of the land allocated for crop 1.18ha was owned and 1.4 ha rented. About 1.2 ha, 0.89 ha land was allocated for grazing and forage production that could be owned and rented respectively. This optimum private and rented land allocation for grazing might be attributed to the availability of market for forages since West Shoa is located near Addis Ababa. Average irrigated land holding was 0.47 ha and 0.88 ha for own and rented respectively.

The average land holding for crop, grazing and forage and irrigated land in the study area were 2.3 ha, 1.38 ha and 0.17 ha respectively. This result indicated that land holding for crop in rural and per-urban area was higher than in urban, similarly land for grazing and forage and irrigation was higher in peri-urban and rural areas.

The reason might be in urban areas the land for farming is limited due to urbanization and availability of water and irrigable land is higher in per-urban and rural in the study area. The present study is consistent with [10] reported as land holding for crop in the rural areas are higher than other land pattern use in Debremarkos districts.

**Table 3.** Landholding of the household in rural and per-urban areas (ha)

Land allocation	Rural		Urban		Peri-Urban		Total
	N	Mean + SD	N	Mean + SD	N	Mean + SD	Mean + SD
For crop		2.69±1.51		2.05±0.83		2.06±0.07	2.3±0.34
Owned	57	2.69±2.27	4	2.06±0.97	90	1.67 ±0.97	1.18±0.96
Rented	22	1.09±0.77	1	2	30	1.6±1.11	1.4±1
Grazing and forage		1.46±1.02		0.5		1.36±1.14	1.38±1.09
Owed	49	1.3±0.89	2	0.5	82	1.16±0.93	1.2±0.92
Rented	18	0.75±0.48	1	0.5	27	1±0.81	0.89±0.69
irrigation		0.46±0.44		-	54	0.49±0.38	0.17±0.33
Owned	9	0.35±0.26	-	-	53	0.49±0.38	0.47±0.37
rented	1	1	-	-	1	1	0.88

where: N is the number of observation, SD is standard deviation

### 3. 3. Livestock Holding

The average number of livestock holding was described in (Table 4). Cattle were the dominant species raised by 100% of the responding households in all the study areas. The overall average cattle herd size per household was 7.85 TLU. The average cattle per household in urban (7.9TLU) showed slight lower difference than both cattle per household in rural (8.52TLU) and peri-urban(8.52TLU). Local dry cows (1.58 TLU and 1.63TLU) and lactating dairy cows (1.66TLU and 1.50TLU) of rural cattle and per-urban areas (respectively) were slightly higher than local dry cow (1TLU) and lactating dairy cows (0.80) of urban areas. However, the crosses were slightly lower in rural areas than per-urban areas. The study revealed that average local bulls (2.37TLU) in rural areas was higher than local bulls (2.20TLU, 2TLU respectively) in urban and peri-urban areas. Similarly the average local oxen (3.13TLU, 3.03TLU respectively) in peri-urban and rural was higher than the average local oxen (2.93) in urban areas.

**Table 4.** Average livestock per house hold by breed in rural and per-urban and urban areas.

Animal type	Rural (mean ± SE)	Urban (mean ± SE)	Peri-urban (mean ± SE)	Total (mean ± SE)
cattle	8.52±0.77	8.52 ± 0.92	7.9 ± 0.52	7.85 ± 0.40
calves	0.52±.05	0.44 ± 0.11	0.54 ± 0.05	0.52 ± 0.03
female calves	0.34±0.04	0.34 ± 0.09	0.38 ± 0.03	0.36 ± 0.03
male calves	0.25±0.028	0.03 ± 0.05	0.14 ± 0.02	0.16 ±0.02
heifer	1.38 ±0 .19	0.87 ± 0.13	0.97 ±0 .07	1.1 ± 0 .08
local heifers	1.33 ±0.20	1.17 ± 0.17	0.83 ± 0.06	1.07 ± 0.09
crossed heifers	1.17 ±0.67	0.77 ± 0.10	0.96 ± 0.12	0.89 ± 0.08
bulls	2.34± 0.30	1.95 ± 0.28	2.20 ± 0.17	2.21± 0.14
local bulls	2.37±0.31	2.20 ± 0.44	2 ± 0.16	2.16 ± 0.16
crossed bulls	1.65±0.55	1.37 ± 0.14	1.65 ± 0.23	1.55 ± 0.15
oxen	3.01±0.18	2.75 ± 0.71	3.17 ± 0.23	3.1± 0.15
local oxen	3.03±0.18	2.93 ± 0.37	3.13 ± 0.22	3.09 ± 0.15
crossed oxen	2.20	1.10	1.65 ± 0.55	1.54 ± 0.267
lactating cows	1.71±0.16	2.40 ± 0.40	2.13 ± 0.19	2.01 ± 0.12
local lactating cows	1.66 ±0.15	0.80	1.50 ± 0.13	1.55 ± 0.1
crossed lactating cows	3±1.8	2.56 ± 0.44	2.25 ± 0.28	2.38± 0.23

dry cows	1.67±0.16	1.73 ± 0.23	1.95 ±0.15	1.84 ± 0.10
local dry cows	1.58±0.15	1± 0.2	1.63 ± 0.13	1.59 ± 0.1
crossed dry cow	1.2	1.87 ± 0.21	1.72 ± 0.21	1.71 ± 0.15
sheep	1.18±0.29	0.72 ± 0.20	0.73 ± 0.24	0.91 ± 0.17
goats	0.66±0.15	0.83 ± 0.41	0.55 ± 0.18	0.64 ± 0.14
equine	1.27±0.12	0.73 ± 0.09	1.30 ± 0.13	1.26 ± 0.09
chicken	0.05 ± 0.008	0.10 ± 0.04	0.06 ± 0.008	0.06±0.006
local chicken	0.04 ± 0.01	0.05 ± 0.02	0.04 ± 0.005	0.04±0.004
crossed chicken	0.07 ± 0.012	0.15 ± 0.09	0.06 ± 0.02	0.08±0.02

The observed variation for oxen and bull holdings of locations were probably due to the fact that the rural households give more attention to oxen as source of draught power for crop production and bulls for natural mating of their dairy animal. Local dry cow, local bull and local oxen were higher than cross dry cow, cross bull and cross-oxen in the study area. The average livestock holding in the study was in agreement with the finding of [11].

Sheep, donkey, horse and chicken were the other important livestock species raised by large proportion of households in the study areas. Since majority the households practiced mixed type of farming (livestock and crop) equines had determinant role next to cattle. The higher equine were recorded in peri-urban and rural than urban areas of the study. This might be implied that the farmers highly depend on equines for transportation of their agricultural products as a pack animal. The poor infrastructure development such as lack of adequate vehicles and roads in the study area had forced the farmers to use equines as alternative. Finally the overall mean equine population owned by the respondents (1.26TLU) were important animals next to cattle.

Sheep population was the third important animal in west shoa. The higher sheep mean population was recorded in rural (1.21 TLU) areas than urban (0.72TLU) and per-urban (0.73TLU) of the study area. The average goats reared per household in urban (0.83TLU) was slightly higher than those in rural (0.66TLU) and peri-urban (0.55TLU) areas of the study. The higher number of cattle were reared than goats in the study area and this could be attributed to better adaptation, farming culture of the area. The mean household holding of goats was (0.64TLU) head which was much lower than in previous reports (Tsedeke, 2007) possibly the differences might be the farming systems which was practiced in the highland mixed type of production and pastoral/agro-pastoral system of the study area where a large population of goats is raised.

### **3. 4. Farming system**

From the result revealed in Table 5 about 84.46% of the households farming system was mixed type of production. Similarly About 12.78% and 2.78% of the households were livestock production and crop production. Most of the farmers were practiced mixed type of

farming system. This result indicated that households in the study area depends their livelihood both in animal production and crop production.

Farmers depend in livestock production for their livelihood in peri-urban was higher than rural areas. Some farmers in peri-urban might not have land for crop cultivation so their life depends only in livestock rearing in the study area.

**Table 5.** Type of farming system in Rural, Urban and Peri- Urban

Type of farming	Rural		Urban		Peri-urban		Total		X <sup>2</sup>	P-value
	N	%	N	%	N	%	N	%		
Livestock production	1	1.7	17	81	5	5	23	12.8	103.3	0.001
crop production	-	-	1	4.8	4	4	5	2.8		
mixed production	57	98.3	3	14.2	92	91	152	84.4		
Total	58	100	21	100	101	100	180	100		

The general feeding systems and practices are presented in Table 6. Different groups of feeding practices were exercised for a different dairy production systems in study area. Free grazing system of feeding was the main practice in all of rural area of farmers who owned local dairy cows and also they fed crop residue as supplement. Similar to rural farmers 33.55% of peri-urban households graze their dairy cow and fed crop residue supplement. The feed source in this study was similar with the result of Ulfina [12].

**Table 6.** Type of feed and feeding system in Rural, Urban and Peri-Urban.

Feed resource for livestock	Rural		Urban		Peri-Urban		Total		X <sup>2</sup>	P-value
	N	%	N	%	N	%	N	%		
grazing only for local	3	13.6	-	-	19	86.4	22	100	84.66	0.001
grazing and crop residue as a supplement for local	40	56.3	1	1.4	33	42.3	71	100		
grazing only for local and industrial by product for crossed dairy	-	-	9	4.4	26	73.5	35	100		
crop residue and industrial byproduct for crosses	-	-	10	47.6	11	52.4	21	100		



grazing, crop residue and by products for crosses	-	-	-	-	2	100	2	100		
crop residue + atella for crosses	-	-	-	-	1	100	1	100		
Total	43	27.7	20	12.9	92	59.4	155	100		

About 22.58% of the households in urban and peri-urban have owned both local and crossed cows and they follow feeding system of free grazing for local and industrial byproducts as stall feeding separately. Finally about 15.48% of the households of urban and peri-urban were manage dairy cows through feeding industrial by products and atella (local brewery byproduct).

The farmers use different water sources for their cattle. As it was indicated in Table (7), about 12.26% of the total respondents included in the study use water for their cattle from ground wells, 61.9 % from rivers, 23.29 % from the pipe water and 2.58 % from stream. The water source for drinking their dairy cattle was 100% pipe water, whereas the water source in rural was 46.51%,from pond, 41.86% from river, 9.3% from pipe water and 2.33% from stream. The water source for drinking dairy cattle in rural was similar with the report of [13]. Focal group discussion of the farmer revealed that drinking water in the study area was available throughout the year without scarcity.

**Table 7.** Livestock drinking water source

Water source	Rural		Urban		Peri-urban		Total		X <sup>2</sup>	P- value
	N	%	N	%	N	%	N	%		
Pond/dam	18	94.7	-	-	1	5.3	19	100		
river	20	20.8	-	-	76	79.2	96	100		
pipe water	4	11.1	20	55.6	12	33.3	36	100		
stream	1	25	-	-	3	75	29	100		
Total	43	27.7	20	12.9	92	54.4	145	100		

During survey observation dairy barn were categorized as open shaded for local dairy cattle and closed shaded for crossed dairy cows. Improved type of housing barns constructed using locally available and cheap materials was being practiced mainly by urban and peri-urban small holder dairy farmers owning crossbred dairy cattle. According to the results revealed in (Table 8) about 98.71% of the respondents were clean their dairy house at different level of frequency. From a total respondents about 87.1% of respondents were clean

the dairy barns in daily basis and 11.6% of respondents clean in weekly basis whereas 1.29% of the respondents were not clean the dairy barns at all the time.

**Table 8.** Dairy house cleaning and cleaning frequency

Do you clean dairy house	Rural		Urban		Peri-urban		Total		X <sup>2</sup>	P-value
	N	%	N	%	N	%	N	%		
Yes	41	26.8	21	13.7 3	91	59.48	153	100	0.69	0.71
No	2	100	-	-			2	100		
Total	43	100	21	100	91	100	155	100		
Frequency of cleaning										
daily	40	29.6 3	21	15.5 6	74	54.81	135	100	8.52	0.07
weekly	1	5.56	-	-	17	94.44	18	100		
Not at all	2	100	-	-	-	-	2	100		
total	43	100	21	100	91	100	155	100		

#### 4. CONCLUSIONS

The global as well as national demand of milk is high and can be expected to grow because of fast growth rate of the population, high income elasticity of demand of milk and development of social values which favors the development of dairy sector. The study showed that smallholder mixed crop- livestock production system (84.46%) is the most common cattle production system in the study area. The results from this study revealed that in urban, peri-urban and rural areas of west shoa the livestock composition is highly dominated by cattle which show the greater contribution of cattle.

Private natural pasture free grazing and crop residues as supplement were the main sources of feed for local dairy cattle in rural area. In urban areas, most of the farms used supplementary feeds such as concentrates, purchased crop residues, hay, concentrates and “Atella”; whereas in the rural areas, dairy farms supplementation is not practiced for dairy animals. The water resource for drinking their dairy cattle was 100% pipe water whereas the water resource in rural was 46.51%, from pond, 41.86% from river, 9.3% from pipe water and 2.33% from stream. The housing condition in urban and peri-urban area dairy farms is better than the rural area farms and the management of animals in urban and peri-urban areas is better than rural areas.

Therefore, understanding the characteristics of dairy production is one step forward for improving for better performance and improvement of dairy cattle. Finally the existing dairy infrastructures should be strengthened and establishment of new ones should be encouraged

by government and non-government institution, with technical assistance and capacity building of producers is recommended.

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( Received 20 July 2016; accepted 08 August 2016 )