Sjournals
Scientific Journals

Agricultural Advances (2015) 4(12) 138-209
ISSN 2251-7820
doi: 10.14196/aa.v4i12.2074

Contents lists available at Sjournals

Agricultural Advances

Journal homepage: www.Sjournals.com

Original article

Status and challenges of smallholder dairy cattle production in the highlands of Bale, Southeast Ethiopia

A. Dawit*, B. Solomon
Sinana Agricultural Research Center, Po Box 208, Bale Robe, Ethiopia.

*Corresponding author; Sinana Agricultural Research Center, Po Box 208, Bale Robe, Ethiopia.

ARTICLE INFO

Article history,
Received 6 November 2015
Accepted 8 December 2015
Available online 13 December 2015
iThenticate screening 8 November 2015
English editing 5 December 2015
Quality control 9 December 2015

Keywords,
Dairy cattle
Feed resources
Production
Reproduction
Systems

ABSTRACT

A diagnostic survey was conducted in the highlands of Bale, Southeast Ethiopia with the objectives to assess the status and challenges of smallholder dairy cattle production. The study area was stratified into two based on the rainfall patters, human and livestock population. For the study the total of 120 households were randomly selected and interviewed using a semi-structured questionnaire. Dairy cattle management system was predominantly traditional. Livestock breeds were almost indigenous local zebu type. About 31.7% of the interviewed households had only a single lactating cow whereas 20% of them did not have lactating cows. Mating was free and commonly seasonal in the area. Almost all classes of dairy cattle were herded together with other livestock species on communal grazing lands. Stall-feeding was, however, practiced in certain cases. Native pasture, crop residues and grazing of aftermath and fallow land are the dominant feed resources available for dairy cattle. Reproductive and productive performances are poor, and mean age at first calving, parturition interval and average calf born per lifetime of local breeds are discussed in the text. Traditional management system coupled with poor nutrition resulted in low milk production in the study area.Therefore, improvement should be made in the area of feed resources and feeding strategies, husbandry practices, health aspects, artificial insemination services and reproductive

performance as well as marketing and market infrastructure to increase milk production and household income in the area.

1. Introduction

Highland regions of Ethiopia are home for 90 percent of the total human and 70 percent of the livestock population in the country (Mohamed-Saleem and Abate, 1995). Livestock provides food, income, manure, fuel and draught power to the farming community in the area (Agajie et al., 2002).

The highlands of Bale are characterized by crop-livestock mixed farming systems (ICRA, 2001; Solomon, 2004). According to Getachew et al (1993), crop- livestock interaction benefits the farming community. Cattle are one of the major source of income in the highlands of Bale even though they are primarily kept as source of draught power with little consideration given to improve their milk production capabilities (Solomon, 2004; ZBARD, 2007). As a result, genetic potential of local breeds for milk production is low. However, their adaptability and survival under the traditional management practices is crucial as compared to the introduced exotic cattle breeds. The highlands of the country in general and that of Bale in particular are densely populated. Thus, effort has to be made to expand and improve livestock husbandry in order to supply animal products particularly milk to this population.

Livestock feed resources are the major constraints mainly during dry season. Natural pasture, crop residue, stubble and weedy fallow grazing are the major sources of feed (Zerihun, 2002; Solomon, 2004). These feed resources are, however, inadequate in quantity and quality, and fluctuates seasonally. Moreover, grazing lands continuously shrinked and declined (Mohamed-Saleem and Abate, 1995; Alemayehu, 2002; Zerihun, 2002). For effective dairy cattle development programme, understanding of the farming systems and production constraints as well as socio-economic condition of the area is essential. Developing appropriate interventions so as to assist smallholder dairy households, and identifying those which should be targeted requires a clear understanding of the dairy systems. Therefore, the objective of this study was to assess the status and production constraints of dairy cattle in the highlands of Bale, Southeast Ethiopia.

2. Materials and methods

2.1. The study site

The study was conducted in Bale highlands of Southeast Ethiopia. The highlands areas (with more than 2000m asl.) were stratified into two based on the rainfall patters, human and livestock population. Among several districts, Sinana (areas that receive bimodal rainfall) and Dinsho (with monomodal rainfall pattern) were selected purposively due to high human population and potential in dairying. Taking the area coverage into consideration, eight representative villages were selected from the districts.

Ambient temperature ranges between 9.4^{o}C and 21.2^{o}C in Sinana area while Dinsho area has a mild sub-tropical highland climate with annual mean minimum and maximum temperature of 2^{o}C and 20^{o}C, respectively (Williams, 2002). Temperature tends to be more severe with a high probability of frosts during the nighttime particularly at higher altitudes of Dinsho area. The rainfall distribution pattern is characterized by one eight- month rainy season from late March to October in Dinsho area (Williams, 2002) while Sinana area receives a bimodal rainfall. The main rainy season (locally known as *bona*) extends from August to December and the short rainy season (locally called *ganna*) stretches from March to July. The dry season in Sinana area covers from December to March. The precipitation during the main rainy season ranges from 270 to 560 mm and that of the short rainy season is from 250 to 560 mm (SARC, 2001).

2.2. Sampling technique and statistical analyses

Secondary data were collected from related sectors in the study area. Semi-structured questionnaire was developed, and a total of 120 households were randomly selected and interviewed. Information on major feed resources and feeding systems of dairy cattle, seasonal availability and feeding calendar, feed conservation

practices, dairy cattle husbandry practices and diseases were collected. Using participatory rural appraisal (PRA) technique, relevant data were also generated. Descriptive statistics was employed using SPSS 10.0 (Statistical Package for Social Sciences) to describe various variables in the dairy cattle production systems.

3. Results and discussion

3.1. Household characteristics and gender wise activities

Almost all of the respondents in Dinsho district were male since socio-culturally females are rarely allowed to speak and discuss in a public forums. In Sinana area 97.6 and 2.4% of them were male and female household heads, respectively (Table 1). The proportion of Muslim and Christian respondents is comparable in Sinana area. However, most of the respondents were native muslim communities in Dinsho area. The bigger family size observed in Dinsho area might be due to the higher rate of polygamy. About 39.2% and 14.2% of the education background of the overall respondents were at primary level and junior secondary schools respectively. While 22.5% of them did not have formal education and 23.3% of the household heads have received neither basic nor religious based education.

Table 1
Summary of household characteristics (in percent of respondents).

Parameters		Percent respondents		
		Sinana district	Dinsho district	Overall
Sex of household heads	Male	97.6	100	98.3
	Female	2.4	-	1.7
Religion of household heads	Muslim	40.5	63.9	47.5
	Orthodox	54.8	30.6	47.5
	Protestant	4.7	5.5	5
Level of Education	Illiterate	23.8	22.2	23.3
	Basic education	20.2	22.3	22.5
	Primary (1-6)	36.9	44.4	39.2
	Secondary (7-8)	16.7	8.3	14.2
	Above secondary	2.4	2.8	0.8

The major source of labour in the area is family and hired for both permanent and causal activities. However, herding is not a problem during the dry season as free grazing is common. The involvement of women in out-door activities is limited due to socio-cultural reasons. Most of the indoor activities related to dairying are undertaken by female member of the households while that of out-door duties are handled by males. However, in some cases there is an overlap of the role of gender on some activities (Table 2).

Table 2
Gender matrix for dairy cattle husbandry.

No	Activities	Gender Role			
		Male	Female	Girls	Boys
1	Herding	√	√	√	√
2	Barn construction	√			√
3	Barn cleaning		√	√	
4	Feed collection and storage	√	√		√
5	Stall-feeding	√	√	√	√
6	Milking		√	√	
7	Dairy cattle marketing	√			
8	Milk and milk product marketing		√	√	

3.2. Trend in agricultural production

Concerning the trend in agricultural production, farmers in the area pointed out that before two decades, livestock production had dominated the area but now, because of the increment of human population, land cultivation is alarmingly increasing so as to satisfy high grain demand. Similarly, the availability of improved seeds, herbicides, tractors and combine harvesters in the area increased the demand for crop production. ICRA (2001) also reported similar reasons for shifting of farming systems from livestock to crop dominant mixed farming systems in the area. Currently, pasturelands are highly fragmented and unfavorable topographies are put under cultivation. As the result, shortage of grazing land is aggravated in the area.

3.3. Dairy cattle production

3.3.1. Dairy cattle type and structure

Majority of the households had less than two dairy cattle by type (Table 3). About 31.7% of the interviewed households had only a single lactating cow whereas 20% of them did not have lactating cows. This could be due to shrinkage of grazing lands, which is resulted in the need for more labour for cattle herding. In general, about 10.7, 41.7, 67.5, 58.3 and 73.3% of the respondents had no calves, heifers, pregnant heifers, pregnant and dry cows, respectively. Though very few households with large herd size in Dinsho area keep breeding bulls, there is reportedly shortage of them in the study area in general. Dual-purpose intact animals, which are mainly used for cultivation, were rather used for mating purpose. About 95% of the interviewed households did not have steers (any intact animal). Thus, female animals could be served by bull from the surrounding herds since free-grazing system of livestock production is dominant in the area.

Table 3
Dairy cattle distribution (in percent of the respondents).

Type of animals	None	1*	2	3	4	Above 5
Calf	10.7	32.5	27.5	17.5	4.2	8.2
Heifers	41.7	30.8	16.7	7.5	1.7	1.6
Pregnant heifers	67.5	24.2	5.0	2.5	-	0.8
Pregnant cows	58.3	20.8	14.2	5.0	1.7	-
Lactating cows	20.0	31.7	27.5	12.5	0.8	7.5
Dry cows	73.3	19.2	3.3	2.5	0.8	0.8
Steers	95.0	2.5	1.7	0.8	-	-

*= Herd size in number.

The cattle population in the study area is predominantly local breed types except in urban and pre-urban areas where few farmers keep crossbreeds. Local zebu cattle breed, which is locally known as Arsi breed type, exists in the area. With medium horn and body size, the dominant color of cattle is black, brown, light brown and black with patches. Climate type of the area might also affect the type of color. Exotic breeds are crosses of Holstein-Friesian up to 50-85% exotic blood level in urban and pre urban areas. They have been introduced into the farming community by zonal Bureau of Agriculture and Rural Development Office (BARD). In all the study areas, cows dominate the herd followed by heifers, calves, oxen and bulls. Farmers keep more cows with the objective of maintaining the breeding stock in general and to produce oxen for draft power in particular. Besides, farmers reported that adequate milk for household consumption (particularly for children below the age of 3) could be achieved through keeping several cows as production per local cow is low.

3.3.2. Herd establishment

In the study area, there are two major means of dairy cattle herd establishment: from own herd and from out side source (purchases from neighbours or other market centers). Selection parameters considered include: milk yield, size, colour, shape, udder size and shape, fertility, disease resistance, and pedigree information (Table 5).

Table 5
Farmers' selection criteria of dairy cattle in Bale highlands of Southeastern Ethiopia (based on farmers view).

Selection parameters	Respondents in percent N = 120	
	From outside stock	From own stock
Milk yield	13.3	22.5
Size	15.8	10.8
Milk yield and mothering ability	4.2	15.8
Milk yield and size of the animal	15.8	19.2
Milk yield and fertility of the cow	2.5	0.8
By asking pedigree of the animal	10.8	4.2
Shape and size	11.7	0.8
Mothering ability milk yield and size	3.3	2.5
Animal size and having information of the animal	10.8	0.8
Milk yield, size and color	5	0.8
Milk yield, mothering ability, size and shape	2.5	12.5
Milk yield, size and color	2.5	2.5
Other	4.2	6.8
Total	100	100

N= Number of household heads interviewed.

In case of purchasing the animal from outside, size of the animal was the major selection criteria followed by milk yield. About 15.8 and 13.3% of the respondents consider size of the animal and milk yield potential, respectively. Similarly, combination of size and milk yield potential contributes about 15.8% in selection of the dairy animals (Table 5). According to the respondents, even though the animal is not good milk yielder but of good size and shape, it has still market values for other purposes. Similarly, a dairy animal with poor performance in terms of milk yield but with shorter parturition interval is allowed to stay in the herd.

3.3.3. Dairy cattle reproduction

According to the respondents, average age at first parturition was 4.36 years (Table 4). Yitaye et al (2000) also indicated that the average age at first calving to be 4-5 years for indigenous cattle in Awasa Wereda. Calving interval was lower in Dinsho (15 months) than in Sinana area (19.21 months). This may be related to the production environment of the area, genetic background of the animal and management level of the dairy cattle, affecting overall production expected from the animal in the area. Peter (1993) also reported that milk yield is determined by the calving interval, rate of milk synthesis and stimulation of let-down where the interactive effect of these three factors needs to be reflected in the selection criteria for milk production performance. The calving interval expresses the economic importance of reproduction since cows with narrower calving interval could give birth to more calves per lifetime (Bonnier et al., 1996).

Average calves born per lifetime of the cow were 6.6 and 6.26 calves in Sinana and Dinsho areas, respectively (Table 4). This could be affected by the production environments of the animal. According to respondents, average weaning age for calves was 10.9 and 9.6 months in Sinana and Dinsho districts, respectively. Weaning age for livestock in the area depended on the level of management. There may be advantages of both early pregnancy and extension of lactation period under good nutrition.

Reproductive and productive performance of the dairy cattle is very poor in response to feed shortage. Longer parturition interval and maturity age, low lactation length and milk yield were reported by farmers. Farmers usually classified their dairy cattle according to milk yield and parturition interval. They call *koticha* for breed types that give more milk yield per lactation and *bakku* for low milk yielder. The cow that gives birth more frequently than others is locally known as *tadhi*. Beside feed and husbandry practices, the type of breed and the health of animal have its own contribution to the poor reproductive and productive performance of the animal.

Table 4
Mean age at first parturition, parturition interval and number of offsprings born per lifetime of animal in Bale highlands (based on farmers view).

Parameters	Sinana district*	Dinsho district**	Overall
	Mean ± SE	Mean ± SE	Mean ± SE
Age at 1st calving (in years)	4.45 ± 0.28	4.17 ± 0.21	4.36 ± 0.21
Calving interval (in months)	19.21 ± 0.80	15 ± 1.33	17.95 ± 0.71
Calf born per life time	6.6 ± 0.26	6.26 ± 0.30	6.49 ± 0.20
Age at weaning (months)	10.93 ± 0.36	9.56 ± 0.74	10.52 ± 0.34

SE = Standard error, *=Area with bimodal rainfall pattern, **= Area with monomodal rainfall pattern.

Mating is uncontrolled whereby female animals were served by natural mating at random by any intact male in the herd. But, in some cases selection is undertaken either by castration or selling of undesirable male animals. Seasonal mating is common for cattle in both areas. This may be synchronized with the availability of adequate feed (pastureland, crop residues and stubble grazing). This shows that management practices vary across season to affect reproductive and productive performance of the animals.

3.3.4. Dairy cattle health

Disease and parasites are among the major constraints that contributed to the low productivity of dairy cattle in the highlands of Bale. According to the respondents, livestock diseases and parasites infection are more critical at the time of feed shortage. They reported that infestation by endo-parasites such as liver fluke (*Fasciola hepatica*) and intestinal worms are one of the main causes of mortality particularly to that of calves. The intensity of this infestation is more acute from July to September when grazing is practiced mostly on swampy sites especially in Dinsho areas.

In agreement to Solomon 2004, the major diseases of dairy animals reported in the study area includes brucellosis, mastitis, foot and mouth disease, black leg, contagious bovine pleuropneumonia (CBPP) and pasteurollosis. Heart water and pneumonia are also the main causes of death in calves. Even if veterinary service is provided by government, inadequate livestock health clinic and lack of skilled manpower aggravated the problem. Vaccination is given mainly during the outbreak for the prevention of some diseases such as anthrax, CBPP, pasteurollosis and black leg. Mostly, farmers themselves purchase veterinary drugs from private drug stores to treat the animals. This is mostly the case when veterinary clinics are allocated far from the farm rendering transportation of sick animals to the clinic difficult. Beside infectious diseases, nutritional diseases are reported by the households mainly at the end of rainy season. For instance, bloating is a common phenomenon when the natural pasture is dominated by *Trifolium* species and grazing is not allowed early in the morning. Generally, the effects that disease and parasites can have on output can be direct or indirect (Putt and Hanks, 1993). Direct effects include mortalities and morbidity effects on production parameters such as milk yield, weight gain and fertility outputs. That is why the reduction in milk yield and death occurrence due to diseases is considered as the economic loss in dairy cattle production.

3.3.5. Feed resources and feeding practices

Natural pasture, crop residues and stubble grazing are the major feed resources for dairy cattle in the highlands of Bale (Tables 6 and 7). Fallow lands also serve as feed resource during off-season when cultivation is suspended for certain reasons. Farmers also used weeds from cropland particularly wild oat (*Avena fatua)* for feeding of lactating and draught oxen during wet season.

Grazing of natural pasture is the most important feed resource followed by crop resides (Table 7). Most of the grazing lands in the highlands of Bale are communal whereby grazing was practiced throughout the year. In general, grazing is undertaken around homestead, on fallow lands, hillsides, roadsides, riverbanks and on swampy areas that are not suitable for cultivation and residence. However, these pasturelands are poorly managed. This is evidenced by overgrazing that resulted in poor growth of grasses and domination of pasturelands by unpalatable species. It was reported (ICRA, 2001; Solomon, 2004) that in the past *kalo* system (delay of grazing of pasturelands for certain months) was practiced when there was adequate communal pasture lands in the highlands of Bale.

Table 6
Major feed resources used for dairy cattle in Bale highlands (based on views of 120 household heads).

Parameters	Frequency	Percent respondent
Crop residues	33	27.5
Grazing land	36	30
Haymaking	2	1.7
Crop residues and grazing land	46	38.3
Crop residues and haymaking	2	1.7
Others	1	0.8
Total	120	100

Table 7
Basal feed resources used for dairy cattle feeding ranked based on the response of households in Bale highlands (based on views of 120 household heads).

Basal feed	Rank base on importance (%)			
	1	2	3	Not considered
Crop residues	44.2	53.3	1.7	0.8
Grazing land	53.3	43.3	2.5	0.8
Haymaking	1.7	3.3	84.2	0.8

In Dinsho area, pasturelands around the residence are open only for calves, late pregnant cows and animals in early lactating. As cultivation is the priority area practiced by the farming community in the area that receive bimodal rainfall, oxen are given priority followed by lactating animals. In some peasant associations located far from grazing areas, the problem of feed shortage is more severe especially for calves. Hence, calves were given fresh grasses, occasionally mixed with flour of roasted barley grain (locally called *konso*) starting from age 2-4 weeks. Supplementation was rare unless the cow is lactating and good milk yielder as well as pregnant. In some cases pasturelands are reserved for grazing of draught animals where cultivation is a primary means of living. These lands are protected from animals during the wet season mainly from July to November for rejuvenation of the existing grass cover and opened for grazing at the end of rainy season. This is inline with the findings of Solomon (2004) who reported enclosure of pasturelands for feeding of draught oxen in areas with bimodal rainfall pattern of Bale highlands. This is because in the bimodal rainfall areas, crop production is a major means of living where draught animals are the backbone of cultivation.

The major crop residues available for livestock feeding included residues from cereals (wheat, barley and emmer wheat), pulses (field pea and faba bean), linseed and maize crops in Sinana area. The magnitude of availability of each type of crop residues varied significantly from place to place and season to season. According to Solomon (2004), out of the feed supplied by crop residues, 56.3% was wheat, 28.3% barley, 8.7% emmer wheat straw as well as 4% maize stover in Sinana. Pulses (field pea and faba bean) and linseed straws contribute only about 2% and 0.8%, respectively. In these areas, crop residues were considered as one of the major feed resource. This is because more lands are put under cultivation. However, crop residues are nutritionally poor to support livestock production (Van Soest, 1982; Owen and Aboud, 1988; Ørskov, 1988; McDonald et al., 1995). This is in agreement with the findings of Solomon (2004) that crop residues and dry feeds (hays harvested during the dry season) in the highlands of Bale contain high crude fiber but low crude protein (less than 7%) as well as with low *in vitro* dry matter digestibility (IDMD), suggesting the need for improvement of feeding value of crop residues through supplementation.

Some urban and pre-urban livestock producers used to feed linseed cake and other agro-industrial by-products to their dairy animals. But, these agro-industrial by-products were not adequately available in the area. Besides, some home available supplements and residues of local brewery products such as *atala*, with mill house by-products are fed to dairy animals with special attention to lactating animals. In general, concentrate of linseed and mill house by-products were mostly available in the 'nearby rural towns, and are used mainly for lactating cows. The availability and cost of concentrates varied from season to season, which affect the extent of utilization. On the other hand, forage crops were not widely cultivated because of scarcity of forage seeds, lack of knowledge of production and feeding techniques and poor extension services in the area (Solomon et al., 2005). About 27.5%

of the respondents cultivated improved forage crops mainly fodder oats (*Avena sativa*). This may be due to the availability of seeds of fodder oat, ease of management and feeding techniques unlike forage legumes. In spite of this, farmers had great interest to grow and utilize these improved cultivated forage crops including vetch and perennial grasses.

Feeding systems in the highlands of Southeastern Ethiopia was based on the purpose of livestock rearing. In most cases animals of different species irrespective of their age and sex are allowed to graze simultaneously. However, lactating animals receive special attention especially during the first weeks of parturition. View of household in giving priority of feeding also differed among household members. For instance, female households like to give especial attention to the dairy cattle particularly to the lactating animals. This could be related to the immediate advantage received from these animals by the female members of households.

According to the respondents, the productivity of dairy cattle particularly lactating animals was affected not only by feed quality and quantity but also by the availability of drinking water. This is because lactating cows (especially at early lactation) consume more water than dry cows of similar weight fed on maintenance level in order to use for milk excretion (Maynard et al., 1981). Dairy cattle in Sinana area spent extra time and energy looking for drinking water especially during the dry season when there are no water catchments. Rivers, streams and ponds are the major water source for livestock but far from home and grazing areas especially during the dry seasons. Large ruminants all together drink water twice or more in a day in areas where river, springs or pods are in the vicinity. However, dairy cattle are watered daily or once in two days based on the availability of water source. The quality of the water is very poor in most part of the study area and it is far away from grazing areas in some villages. But, Little and Shaw (1978) reported that the provision of adequate quantities of clean water is a major prerequisite for satisfactory milk production, growth and animal health. Similarly, water intake of the animals is influenced not only by live weight, dry matter (DM) ingested and DM digested but also by climatic condition, consumption of the diet, characteristics of water supply and physiological state of the cattle (Little and Shaw, 1978; Jenet et al., 2004). The types of feed also play a decisive role for water intake. In general, watering frequency and time taken to the water source can directly affect the productivity of dairy cattle.

3.3.6. Milk production and processing

According to the respondents, milk yield from local cows ranged from one to three litters on average in general in the first 2-3 months of lactation during wet season and less than a liter per day per animal thereafter. However, the yield is varying from season to season depending mainly on the availability of feed and farmers' management practices. It also varies from cow to cow as well as from location to location. During growing period, most of the lactating animals give birth when forage is relatively available. Similarly, Mburu et al (2005) reported that milk yield varies widely with breeds of dairy animals used, of land and labour uses and feeding systems of dairy cattle. During this period minimum proportion of milk produced went to the local market either as liquid milk or in the form of butter or local cheese (locally known as *ayib*). The large part of milk produced was used for family consumption especially for children. Though fresh milk selling was taboo in the past, currently it becomes one of the major income sources for female households.

Milking is the responsibility of female members of the households and undertaken twice a day, early in the morning and in the evening. The entire households practiced is hand milking. Female members of the family usually perform milk-processing activities. Milk containers (also called *qodaa* or *elemtuu* in local language) are traditionally made from sewing of *Pennisetum schimperi* (locally known as *hodha-migira*) or wood. It can be also used for temporary storage of milk and milk products. Milking, milk processing and storage equipment are washed with the leaves of some plants such as *Lippia adoensis* (*kusahe)* and *Cymbopogon citrates* (*tajisar*). Women in the area used to smoke their milking vessels with burning chips of *Olea Africana* (locally called *Ejersa)* and *Juniperous procera* (*Hindhessa or Gattira*). This is inline with the finding of Lemma et al (2005) that reported fumigation of milking vessels using the same plant species in the rift valley areas of Ethiopia. Fumigating milking vessels is supposed to increase fermentation time and improve flavour of the milk. It is also reported (Mogessie and Fekadu, 1993) that fumigation reduced the undesirable microbial contamination that enhances fermentation rate.

In most cases, butter-making is the responsibility of housewives and female member of the households. For butter-making, milk is collected for a period of three to four days in milk storage equipment such as clay pot. After sufficient milk is collected and soured, the pot is shaken back and forth until butter recovery. The spices like ginger, garlic and *Thymus schimperi* (locally called *xosinyi)* are added to butter to improve its shelf life and taste. Milk can be stored and preserved during wet season when feed and water is relatively available and more cows are under

lactation. On the other hand, butter can be preserved in locally made equipments (*elemtu, qoda* or *buqqe*) for more than seven years. Farmers reported that such type of butter has a medicinal value. Nowadays, keeping butter for long period of time is rarely observed due to low milk production particularly in Sinana area where there is shortage of grazing land and feed scarcity. With respect to taste and butter yield, milk of local breeds is preferred to that of exotic ones. This might be related to the higher fat content of milk from local breeds (Arsi breed types).

3.3.7. Marketing

Farmers reported that the price of animals is affected by season, location of market center and period of the year. Not all the productive dairy animals are taken to the market. Dairy animals with good performance are sold first either to the relatives or neighbours. Pricing of the animals at the market is based on bargaining and negotiation between cattle owners and buyers.

Milk and milk products are sold mainly in the rural markets. Even though production inputs such as feeds are relatively cheap, there was lack of market for fresh milk for areas far from towns. It takes too long time for fresh milk to reach where there is good market. The producer-consumer market linkage is poor. Though farmers are well aware of the role of milk to the households' income, due to the above factors, they could not generate reasonable income from the sell of fresh milk.

3.3.8. Production constraints

Shortage of grazing land and inadequate feed (both in quantity and quality) is the most critical constraint to smallholders' dairy cattle production systems in the highlands of Bale. Traditional husbandry practices and poor feeding system also contribute to the poor reproductive and productive performance. The incidence of disease and parasites are among the major constraint that contributes to the low production and productivity of smallholder dairying. Moreover, the existing local breed types are genetically poor in milk production. Selection is rarely practiced in the area. They are characterized by late age at calving and low breeding efficiency, which leads to (smaller number of calf crop and lower milk yield per lifetime) reduced lifetime productivity. For genetic improvement of the local breeds for milk production, lack of artificial insemination services is one of the problems in the area. Abdinasir (2000) also reported a similar result for dairy cattle in Arsi zone of Ethiopia. On the other hand, milk and milk product marketing systems is not encouraging for producers far from market centers. Such problem is also aggravated by the poor infrastructure development, poor handling of milk and milk products

The other problem was poor access to the resources needed to enable them to achieve the necessary transformation from the use of traditional management practices to modern system of production. Milk production systems in the area are following traditional management where communal grazing lands are the major feed resource. Thus, this is the major impediment to the adoption of improved dairy cattle husbandry practices. However, communal grazing lands are currently shrinking. Besides, farmers are reluctant to allocate private lands for livestock grazing that limit adoption of improved livestock husbandry practices. This problem is also aggravated by lack of livestock research and poor extension services in the area. In general, milk production decreased from time to time, mainly due to feed shortage, expansion of cultivation, livestock diseases and poor genetic potential (reproductive and productive performance) of indigenous cattle in the highlands of Southeastern Ethiopia.

4. Conclusion

Cattle play a significant role in providing food (milk and meat), draught power, income, manure and fuel to the community in the highlands of Southeast Ethiopia. However, dairy cattle husbandry practices are almost traditional. Inadequate feed resources both in quantity and quality especially during the dry season as well as livestock diseases were the main limiting factors of dairy cattle production.

Natural pasture and crop residues are the dominant feed resources in the study area. The quantity and quality of natural pasture and crop residues produced annually are fluctuating throughout the year. Cereals straw are widely available in areas with bimodal rainfall pattern but they are nutritionally poor to increase dairy cattle productivity. Hence, to bring a meaningful increase in dairy cattle productivity in the highlands of Bale, dairy animals should be supplemented with a reasonable quantity and quality feeds. Similarly, traditional husbandry

practice, management of natural pasture and feeding value of crop residues should be improved to enhance dairy cattle productivity in the area.

Poor productivity might be due to lack of selection breeding of the genetically superior breeds among local breeds. Hence, importance of the productivity of indigenous breeds through selection program should be induced in the area.

Besides, Artificial Insemination (AI) service is inefficient, which is exacerbated by unavailability of adequate technicians and poor facilities and logistics. But, AI has been taken as one of the major options for genetic improvement of dairy cattle in the country in general. Therefore, effort has to be made from research side so as to help the extension systems in dairy cattle production in the Ethiopian Southeastern highlands.

Acknowledgement

The author would like to thank farmers for participating in the study, and sharing their knowledge. Staffs of Sinana Agricultural Research Center (SARC) as well as Development Agents in the study area are highly acknowledged for their cooperation in every regards. Finally, the authors also like to thank SARC for the provision of research facilities during the study, and the Ethiopian Agricultural Research Organization (EARO) for funding the study.

References

Abdinasir, I., 2000. Smallholder dairy production and dairy technology adoption in the mixed farming system in Arsi highland, Ethiopia. Ph.D. Thesis, Humboldt University, Berlin, Germany. 146.

Agajie, T., Chilot, Y., Mengistu, A., Elias, Z., Aster, Y., 2002. Smallholder livestock production systems and constraints in the highlands of North and West Shewa zones. Proceedings of the 9th Annual Conference of the Ethiopian Society of Animal Production (ESAP) held in Addis Ababa, Ethiopia, August 30 - 31, 2001. 49-72.

Alemayehu, M., 2002. Forage production in Ethiopia: A case study with Implication for livestock production. Ethiop. Soc. Anim. Prod. (ESAP), Addis Ababa, Ethiopia. 106.

Bonnier, P., Maas, A., Rijks, J., 1996. Dairy cattle husbandry, 1st ed., Agromisa foundation Publ. with the Technical Center for Agricultural and Rural Cooperation (CTA). AGRODOK 14. 80.

Getachew, A., Zerbini, E., Abate, T., 1993. Crop- livestock interaction and implications for animal traction research in the Ethiopian highlands. In: Proceedings of the 4th National Livestock Improvement Conference (NLIC) Held in Addis Ababa, Ethiopia, 13-15 November 1991. 29-36.

ICRA (International Center for Development Oriented Research in Agriculture), 2001. The shift to Cereal Mono-cropping, a threat or a blessing. Toward Sustainable Agricultural Production in the Wheat-barley Farming System in the Highlands of Southeast Oromia, Ethiopia. ICRA- Ethiopian Team, Working Document Series 92, Ethiopia. 189.

Jenet, A., Asfaw, Y., Azage, T., Fernandez-Rivera, S., Kreuzer, M., 2004. Water intake and nutrient balance of Holestein Boran cows fed a low-quality tropical diet. Ethiop. J. Anim. Prod. 4(1), 1-10.

Lemma, F., Fekadu, B., Hegde, P.B., 2005. Traditional milk and milk products handling practices and preservation methods in three districts of East Shoa zone of Oromia. In the 12th Proceedings of the Ethiopian Society of Animal Production (ESAP), August, Addis Ababa, Ethiopia, 2, 77-84.

Little, W., Shaw, S.R., 1978. A note on individuality of drinking water by dairy cows. Anim. Prod. 26, 225.

Maynard, L.E., Loosli, J.K., Hintz, H.F., Warner, R.G., 1981. Animal nutrition, 7th ed., Tata McGraw-Hill Publ., New Delhi. 602.

Mburu, L.M., Wakhungu, J.W., Kang'ethe, W.G., 2005. Characterization of smallholder dairy production systems for livestock improvement in Kenya highlands. Livest. Res. Rural. Dev. 19, Article 8, Retrieved December 26, 2007 from http://www.cipar.org.co/irrd/irrd19/8/mbur19110.htm.

McDonald, P., Edwards, R.A., Greenhagh, J.F.D., Morgan, C.A., 1995. Animal nutrition. Longman group, Harlow, UK. 607.

Mogessie, A., Fekadu, B., 1993. Effect of container smoking and cleaning on the micro flora and keeping quality of raw milk from a dairy farm in Awassa, Ethiopia. Trop. Sci., 33, 368-376.

Mohamed-Saleem, M.A., Abate, T., 1995. Feed improvement to support intensification of ruminant production systems in the Ethiopian highlands. In: Proceedings of the 3rd Annual Conference of the Ethiopian Society of Animal Production (ESAP), 27-29 April, Addis Ababa, Ethiopia. 296-306.

Ørskov, E.R., 1988. Consistency of differences in nutritive value of straw from different varieties in different seasons. In: Proceedings of a Workshop on Plant Breeding and Nutritive Value of Crop Residues, 7-10 December 1987, Int. Livest. Cent. Afr. (ILCA), Addis Ababa, Ethiopia. 163-176.

Owen, E., Aboud, A.A.O., 1988. Practical problems of feeding residues. In: Proceedings of a Workshop on Plant Breeding and Nutritive Value of Crop Residues, 7-10 December 1987, Int. Livest. Cent. Afr. (ILCA), Addis Ababa, Ethiopia. 133-156.

Peters, K.J., 1993. Selection and breeding strategies for sustainable livestock production in developing countries with particular reference to dairy cattle production. In: Proceedings of the British Society of Animal Production-Occasional 16(1993), 119-128.

Putt, S.N.H., Hanks, J.D., 1993. The identification and evolution of disease constraints for extensive livestock production systems. In: Proceedings of the British Society of Animal Production-Occasional, 16(1993), 93-100.

SARC (Sinana Agricultural Research Center), 2001. Profile of Sinana agricultural research center. Oromia. Agr. Res. Instit. Bulletin, 1, November. 31.

Solomon, B., 2004. Assessment of livestock production system and feed resource base in Sinana Dinsho district of Bale highlands, Southeast Oromia. M. Sc. Thesis. Alemaya University, Alemaya. 135.

Solomon, B., Bekele, M., Dawit, A., 2005. Summary of livestock research strategy for Bale zone (feed resources, dairy, small ruminants, animal health and apiculture programs). Oromia. Agr. Res. Instit, Sinana. Agr. Res. Cent. June. 31.

Van Soest, P.J., 1982. Nutritional ecology of the ruminants, O and B Books. Inc. Oregon, USA.

Williams, S., 2002. Bale mountains: a guidebook. 52.

Yitaye, A., Azage, T., Mohamed, Y.K., 2000. Livestock production systems in three peasant associations of the Awasa Wereda. Proceedings of the 8th Annual Conference of the Ethiopian Society of Animal Production (ESAP), August 24-26, Addis Ababa, Ethiopia. 155-167.

ZBARD, 2007. Zonal Bureau of Agriculture and Rural Development (BARD). Annual Report, June, Bale Zone, Robe, Ethiopia.

Zerihun, H., 2002. Land use conflicts and livestock production in Enset- livestock mixed farming systems in Bale highlands, Southern Ethiopia. M. Sc. Thesis. The Agricultural University of Norway, Aas. 66.

How to cite this article: Dawit, A., Solomon, B., 2015. Status and challenges of smallholder dairy cattle production in the highlands of Bale, Southeast Ethiopia. Agricultural Advances, 4(12), 138-209.