academicJournals

Vol. 7(2), pp. 5-11, February 2016
DOI: 10.5897/IJLP2015.0276
Article Number: A20CF1858015
ISSN 2141-2448

http://www.academicjournals.org/IJLP

International Journal of Livestock Production

*Review*

# A review on cattle husbandry practices in Ethiopia

**Andualem Tonamo**

Department of Animal and Range sciences, Madawalabu University, Ethiopia.

Received 30 September, 2015; Accepted 9 November, 2015

**The aim of this paper was to review cattle husbandry practices (feeding, breeding, watering and health care) and production systems in Ethiopia, identifying constraints limiting the production and quantifying cattle feed resources, specifically. Highland crop-livestock farming system in Ethiopia encompasses nearly 40% of the country's land area, while lowlands areas cover about 60% of the country's land area. The sector is characterized by pastoral and agro-pastoral production systems. The major constraints that limit cattle production in Ethiopia are genetic resources, shortage of feed and water, climatic factor, diseases, and poor housing. Major feed resources for cattle in the country are natural pasture, crop residue, and crop aftermath beyond other non-conventional feed resources. It was concluded that more emphasis should be given to perform applied research to improve cattle production through strong extension services in delivery of veterinary services, improved fodder cultivation and feed conservation, and improved availability of water in different agro-ecologies of the country.**

**Key words:** Constraints, feed resources, production systems.

## INTRODUCTION

In Ethiopia, agriculture is the main economic activity and more than 80% of population is dependent on agriculture in which livestock play a very important role (CSA, 2009). In Ethiopia, agriculture contributes about 50% to the overall gross domestic product (GDP), generates 90% of export earnings, and provides employment for 80% of the population (CSA, 2009). Livestock is an integral part of the agriculture and the contribution of live animals and their products to the agricultural economy accounts for 47% (IGAD-LPI, 2011). Among livestock species, cattle contribute significantly to the livelihoods of farmers. They serve as a source of draught power for the rural farming population, supply farm families with milk, meat, manure, and also as source of cash income, playing a significant role in the social and cultural values of the society. Cattle contribute nearly to all the draught power for agricultural production at smallholder level in Ethiopia (Melaku, 2011). They are also used to generate critical cash in times of scarcity, provide collateral for local informal credit and serve other socio-cultural functions in Ethiopia (Ulfina et al., 2005). Despite the importance of cattle to the farming community in particular and to the national economy at large, the sector has remained underdeveloped and underutilized. According to CSA (2011), Ethiopia has about 52.13 million heads of cattle that produce a total of 3.2 billion liters of milk and 0.331 million tons of meat annually (FAO, 2005; CSA, 2008). In addition, 14 million tons of manure are used annually

*Corresponding author. E-mail: andualemtonamo@gmail.com.

primarily for fuel and 6 million oxen provide the draught power required for the cultivation of crops (Befekadu and Birhanu, 2000).

Ethiopia has an immense potential for increasing livestock production, both for local use and for export purposes. However, expansion and productivity was constrained by quantitatively and qualitatively inadequate and imbalanced nutrition, sporadic disease outbreak, scarcity of water, lack of appropriate livestock extension services, insufficient and unreliable data to plan the services, and inadequate information to improve animal performance, marketing, processing and integration with crop and natural resources for sustainable productivity and environmental health (Aynalem et al., 2011).

Currently, feed is the main constraint limiting livestock productivity in the country and there are seasonal fluctuations in feed supply in both quantity and quality. Feed shortage and nutrient deficiency are common during the dry season in both highlands and lowlands of the country. Various factors contribute to the low feed supply to livestock. Grazing lands are decreasing due to human population increment and increasingly conversion of grazing land into croplands. Poor soil fertility and unreliable and seasonal fluctuations of rainfall limit the amount of feed obtained and crop residues are low in nutritive value. The use of improved forages by smallholder farmers is not common and utilization of agro-industrial by-products is limited to urban and peri-urban areas. Currently, with increasing human population and demand for crop production, grazing lands are shrinking and livestock are kept in low potential lands that are not suitable for crop production and other purposes (Alemayehu, 2005). This condition is evident in the mixed farming systems of the highlands and mid altitude zones of Ethiopia.

Improvement in cattle productivity can be achieved through identification of production constraints and introduction of new technologies or by refining existing practices in the system. In Ethiopia, the cattle husbandry practice in different agro-ecological zones is not studied fully and farmers' needs and production constraints have not been identified. Identification of overall management activities with their constraints and opportunities associated to cattle production are preconditions for designing suitable cattle production development strategies (Haffernan, 2004). Prioritization of the production constraints is essential as it helps to use the scarce resources efficiently. Understanding the husbandry practice helps to design appropriate technologies, which they are compatible with the existing systems. In general, discussions of the cattle husbandry practice are important to plan development and research activities and bring improvements in productivity. Therefore, this aims to review cattle husbandry practices like breeding system, watering, healthcare, major feed resources and addressing the constraints limiting cattle production in Ethiopia.

## LIVESTOCK PRODUCTION SYSTEMS IN ETHIOPIA

The diversity of Ethiopia's topography, climate and cultural conditions make it difficult to generalize about cattle production systems in the country. Numerous authors used different criteria to classify livestock production systems in Ethiopia. In the highland areas, agricultural production system is predominantly smallholder mixed farming, with crop and livestock husbandry typically practiced within same management unit.

### The highland crop-livestock mixed farming system

The highland crop-livestock mixed farming system encompasses nearly 40% of the country's land area and is located above 1,500 m.a.s.l (NEPAD-CAAD, 2005). It is featured by a mixed farming system where crop cultivation and livestock production are undertaken side by side and complementing each other. According to the same source, about 80% of cattle, 75% of sheep, and 25% of goats from the total national livestock holdings are found in this production system. Despite the contribution of livestock to the economy and to smallholders' livelihood, the production system is not adequately market-oriented (Ayele et al., 2003). There is little evidence of strategic production of livestock for marketing except some sales targeted to traditional Ethiopian festivals. According to the same authors, the primary reason for selling livestock is to generate income to meet unforeseen expenses. Sales of oxen are taken as a last resort and large ruminants are generally sold when they are old, culled, or barren. In the highlands, large numbers of cattle are kept to supply draft power for crop production.

### The lowland pastoral and agro-pastoral production system

The lowlands in Ethiopia cover about 60% of the country's land area and are situated below 1,500 m.a.s.l (NEPAD-CAADP, 2005). The lowlands are situated in the Eastern (Afar and Somali), Southern (Borena and South Omo) and Western (some parts of Gambela and Beneshangul) parts of the country. According to the same source, the sector is characterized by pastoral and agro-pastoral production systems, whereby about 20% of cattle, 25% of sheep and 75% of goats of the total national livestock population are found. The pastoral society, which depends on livestock resources, is able to purchase food grains, cloth and other household items.

Their sources of income include sales of animals and animal products and hiring out of drought animals to the highlanders (Bruke and Taffese, 2000). Livestock are the principal source of subsistence providing milk and cash income to cover family expenses for purchase of food grains and other essential household requirements (mostly consumer goods). The pastoral areas have been

the traditional source of export animals. Some scholars also indicated that to a certain extent, Middle East importing countries have preference to the local breeds of livestock raised in these areas (Mohammed et al., 2007).

## SOCIO-ECONOMIC IMPORTANCE OF CATTLE IN ETHIOPIA

In the mixed crop-livestock systems of the Ethiopian highlands, livestock are subordinate but economically complementary to crop production in providing draft power, which is a vital contribution to the overall farm labor requirement. Cattle also provide meat, milk, cash income and manure, and serve as a capital asset against risk. In the semi-arid low lands, cattle are the most important species because they supply milk for the subsistence pastoral families. In the more arid areas, however, goats and camels are the dominant species reared. The former provide milk, meat and cash income, while the latter population for milk, transport and, to a limited extent, meat.

Cattle are kept for all purpose. However, the purposes of keeping cattle vary with production systems. Traction ranked highest, followed by milk and reproduction/breeding (males and females) in both crop-livestock and agro pastoral systems (Alemayehu, 2004). Manure production also considered important by most crop/livestock and agro-pastoralist farmers, but as secondary rather than a primary purpose. In contrast, reproduction/breeding requirements received higher ranks in pastoralist systems and, for female, requirements for breeding outranked the importance of milk production (Workneh and Rowlands, 2004).

In Ethiopia, 45% of livestock owners are women and 33% of livestock keepers households are headed by women in Addis Ababa city (Azage, 2004). Women are usually responsible for feeding large animals, cleaning the barns, milking dairy cattle, processing milk and marketing livestock products, but they receive assistance of men, female children and/or other relatives. Young children, especially girls between the ages of 7 and 15, are mostly responsible for managing calves, chicken and small ruminants and older boys are responsible for treating sick animals, constructing shelter, cutting grass and grazing of cattle and small ruminants. The role of women in managing animals that are confined during most of the year is substantial. They are critically involved in removing and managing manure, which is made in to cakes and used or sold as fuel (Azage, 2004).

## CONSTRAINTS LIMITING CATTLE PRODUCTION

### Genetic resources

As compared to breeds originated from temperate areas, cattle breeds of the tropics generally have a limited genetic potential for milk production and remain mediocre producers (500 to 1500 kg per lactation) even when the best possible husbandry conditions are available to them (Pagot, 1992). In a general way, the genetic improvement of local breeds for milk production has essentially been obtained by crossing with breeds, which originate from temperate countries. However, the tropical African indigenous breeds have special adaptive traits for disease resistance, heat tolerance and ability to utilize poor quality feed (Tedonkenk-Pamo and Pieper, 2000).

The livestock genetic resources of Ethiopia have involved largely as a result of natural selection influenced by environmental factors. This has made the stock better conditioned to withstand feed and water shortages, diseases challenges and harsh climates. Nevertheless, the capacity for the high level of production has remained low (IPS, 2000). Less than 1% of the 49.3 million cattle populations of Ethiopia are exotic or crossbred dairy cows (CSA, 2008).

### Shortage of feed resources

Availability, quality and quantity of feeds vary among varies production systems. Cattle largely depend on rangeland grazing or crop residues that are of poor nutritive value. Feed is not uniformly supplied and the quality is poor. Natural pasture, browses and bushes account to the major food sources of livestock owned by pastoralists.

Seasonal fluctuations in the availability and quality of feed have been a common phenomenon, inflecting serious changes in livestock production (Alemayehu, 2005). Dry season feed supply is the paramount problem. The feed shortages and nutrient deficiencies are more acute in dry seasons (Tedonkenk-Pamo and Pieper, 2000). In contrast, under normal circumstances, in lowlands, when there are sufficient feed for cows, milk tends to be adequate for home consumption as well as for market (Bruke and Tafesse, 2000).

The natural pastures of the tropics have significant seasonal variations of productivity and nutritive value. Pagot (1992) showed that modern agronomic techniques (selection of forage species, fertilization and irrigation) enable the attainment of productivity very much higher than the best obtained in temperate countries. Tropical climates are favorable to the production of abundant food energy notably in the form of starchy root crops, but the level of production of forage proteins is not high.

### Shortage of water

Since rainfall rather than livestock density determines net primary production and vegetation cover, its variability is the most important climatic factors determining the state of the natural resources base. Hence, rainfall variability

and the correspondingly productivity of the vegetation determines livestock production (Kedija, 2008). Ruminates as any other animal require water to maintain the water content of the body, and water availability affects voluntary feed intake; less water leads to inadequate intake of dry matter. For animals kept under pastoral production system, the frequency of watering is very important. During the dry season, water is available only from wells and some lakes and streams (Ibrahim and Olaloku, 2002). This leads to over grazing around watering points. Water intake increases as watering frequency is decreased and feed conversion efficiency becomes lower as watering interval increase (Ibrahim and Olaloku, 2002). Poor quality of water leads to pathogens and helminthes infestation among the animals thereby resulting in disease outbreaks, higher morbidity and mortality, and lower productivity (Andualem et al., 2015).

### Climatic factors

Numerous experiments have shown that a prolonged period in which temperatures are more than 25°C, particularly in humid air conditions leading to a reduction in dry matter intake by milking cows and, as a consequence, a drop in their production. High ambient temperatures have another depressive action on milk production by reducing the fertility of the cows, thus lengthening the interval between lactations (Pagot, 1992). Another similar study indicated that dairy cattle, like other warm-blooded animals, have their homeostasis most efficiently in environments where they can maintain their body temperature at around 38°C. Tissue and cellular metabolism and the underlying biochemical reactions that sustain life and productive functions need body temperature to be maintained within very narrow limits. Relatively small increases in body temperature, for example, one degree Celsius or less result in detectable and deleterious effects on metabolism and tissue integrity, in particular, the breakdown of body protein and a significant depression in production (Vercoe, 1999).

### Animal healthcare

Animal healthcare and improved health management is also one of the major constraints of dairy development in Ethiopia, which caused poor performance across the production system. Many of the problems result from the interaction among the technical and non-technical constraints themselves. For instance, poorly fed animals have low disease resistance, fertility problems, partly because the animal healthcare system relays heavily on veterinary measures. Moreover, poor grazing management systems continue to cause high mortality and morbidity (e.g. internal parasites). Many of the diseases constraints which effect supply are also a consequence of the non-technical constraints, for example, insufficient money to purchase drugs or vaccines (Ibrahim and Olaloku, 2002).

Contact of livestock brought from various localities through the use of communal pastures and watering as well as marketing places play an important role in the transmission of economically significant infectious and parasite diseases. Such livestock movements could be the cause of direct or indirect transmission of various economically important livestock diseases (Zinash, 2004).

The most serious animal disease constraints to livestock productivity are the parasitic and viral diseases mainly vector-transmitted that have a wide geographic distribution and whose severities are strongly influenced by the environment (Tedonkenk-Pamo and Pieper, 2000). The diseases transmitted by ticks (babesiosis, anaplasmosis, heart water) have been the main justification for a long time of the crossing of Zebus with specialized European breeds for milk production. In improved methods of animal production, the need to favor these practices is considerably reduced (Pagot, 1992).

The low veterinary service performance in the lowlands is the outcome of the government-monopolized services. Government veterinary staffs are few in number and cannot cover such a vast area to adequately address the veterinary needs of livestock keepers. Besides government staffs need adequate mobile facilities for which currently the government does not have the capacity to provide (Tafesse, 2001).

## FEED RESOURCES AND THEIR NUTRITIVE VALUE

Livestock feed resources in Ethiopia are mainly natural pasture, crop residues, improved pastures, forage crops and agro-industrial by products (Alemayehu, 2004). The feeding systems include communal or private natural grazing and browsing, provision of crop residues and cut-and-carry feeding. At present, stock are fed almost entirely on natural pasture and crop residues. Livestock are grazed on permanent pastures, fallow land and cropland aftermath (Alemayehu, 2004).

The major roughage feed resources for dairy animals across all the different production systems included natural pasture/grasslands, crop residues, non-conventional feed resources (e.g. leaf and stem of *enset*, banana and sugarcane, crop thinning) and crop aftermath (with the exception of urban dairy producers). The contribution of these feed resources, however, depends up on the agro-ecology, the types of crop produced, accessibility and production system (Azage et al., 2013).

### Natural pasture

Natural pastures supply the bulk of cattle feed. They are composed of indigenous forage species and are subject to severe overgrazing. Grazing occurs on permanent

grazing areas, fallow land and on land following harvest. The availability and quality of native pasture varies with altitude, rainfall, soil type and cropping intensity. Average pasture yield for the highland areas is estimated to be 4 tons/ha. In many areas, natural pastures are invaded by species of low palatability (Solomon and Alemu, 2009).

**Crop residues**

Crop residues are fibrous materials, which are the by-products of cultivated crops. This is a basic limitation in residues such as straw and stover with crude protein contents around the borderline level of 6 to 7% (Solomon and Alemu, 2009). Most residues are deficient in fermentable energy and minerals. Crop residues have low palatability and digestibility that leads to poor intake, particularly when fed as the sole roughage. The availability of crop residues is closely related to the farming systems, the type of crop produced and the intensity of cultivation. *Teff*, wheat and barley straws are the major residues available in the highlands while maize and sorghum are common in the lowlands. Crop residues are often left in the field or accumulated in places where the crop is threshed. Transportation of crop residues, even over short distances, can become difficult and costly because of their bulk. The production of crop residues is also seasonal, available in very large quantities just after harvest and less available thereafter (Solomon and Alemu, 2009).

The plant species, agronomic practice used, soil, temperature and the stage of growth influence the chemical composition and the palatability of straws. Solomon (2004) reported that there is a considerable variation in the contents of crude protein and crude fiber. However, the quality varies significantly from crop to crop. Residues from leguminous crops have better quality than the residues from cereals. Legume straws contain less fiber, high digestible protein than cereal straws (Solomon, 2004).

**Fodder trees**

Fodder trees and shrubs are important animal feeds in Ethiopia especially in arid, semi-arid, and mountain zones, where large number of the country's livestock is found (Alemayehu, 2004). Most browse species have the advantage of maintaining their greenness and nutritive value throughout the dry season when grasses dry up and deteriorate in quality and quantity. Tree fodders are generally rich in protein, vitamins and mineral elements and can be used as dry season feed sources and supplements to poor quality grasses and crop residues. However, their utilization is reduced by the presence of tannins and other phenolic compounds in their leaves. Compared to grasses, fodder trees and shrubs have relatively high concentrations of crude protein and minerals. These nutrients are subject to less variation than in grasses and this particularly enhances their value as dry season feeds for livestock. However, nutritive value of fodder trees decreases with aging, since they become woody as they mature. Nevertheless, such situation can easily be overcome by regular lopping of the plants.

**Improved (cultivated) pasture and forage crops**

Improved (cultivated) forages yield is higher than the naturally occurring swards and have higher nutritional value. In addition, the length of the productive season is longer for cultivated pastures than for the native pastures, which provide an opportunity to develop and use pasture and forage at a large scale for dairy production and fattening. Several forages have been tested under varying ecological zones for their adaptability and a number of useful forages have been selected for different zones. Improved pasture and forages therefore, have been grown and used in government ranches, state farms, farmers' demonstration plots and dairy and fattening areas (Alemayehu, 2002).

Forage crops are commonly grown for feeding dairy cattle with oats and vetch mixtures, fodder beet, elephant grass mixed with siratro and desmodium species, rhodes/ lucerne mixture, phalaris/trifolium mixture, hedgerows of sesbania, leucaena and tree-lucerne being common ones (Alemayehu, 2006). Due to unprecedented population increase, land scarcity and crop dominated farming, there has been limited introduction of improved pasture and forages to smallholder farming communities and the adoption of this technology by smallholder mixed farmers has been generally slow (Abebe et al., 2008).

Yield of improved pasture and forage ranges from 6 to 8 tons and 3 to 5 tons of dry matter (DM) per hectare, respectively, while that of tree legumes ranges from 10 to 12 tons of DM per hectare. In suitable areas, yield of oat-vetch mixtures are commonly 8 to 12 tons of DM per hectare. Despite the advantages of improved pasture and forage crops, due to land scarcity and crop-dominated farming, there has been limited spontaneous introduction of improved pasture and forages (Alemayehu, 2002).

In Ethiopia, the most improved tropical forage species can be grown in the altitude ranging from lowland to mid altitude (1,500 to 2000 m.a.s.l.) except temperate species, which can grow in areas between 2,100 to 3,000 m.a.s.l. (Alemayehu, 2002). Pasture establishment is relatively difficult in the highlands compared to the humid, warmer and lower areas because of the types of soil and climate.

**Agro-industrial by-products**

Agro-industrial by-products produced in Ethiopia include by-products from flour milling, sugar factory, oil processing

factories, abattoir and breweries. These products are mainly used for dairy, fattening and commercial poultry production and the scope for their wider use by smallholder producers is low due to availability and price (Solomon and Alemu, 2009).

Agro-industrial by-products have special value in feeding livestock mainly in urban and peri-urban livestock production system, as well as in situations where the productive potential of the animals is relatively high and require high nutrient supply. The major agro-industrial by-products commonly used are obtained from flour milling industries, edible oil extracting plants, breweries and sugar factories. The current trends of increasing urban population has a significant effect on the establishment of agro-industries due to the corresponding increasing demand for the edible main products. Agro-industrial by-products are rich in energy and/or protein contents or both. They have low fiber content, high digestibility and energy values compared with the other class of feeds (Zinash and Seyoum, 1991).

Alemu et al. (1991) also reported more than 35% crude protein (CP) and 50 to 70% *in vitro* organic matter digestibility (IVOMD) for oil seed cakes and 18 to 20% CP and more than 80% IVOMD for flour milling by-products. Supplementing ruminants fed low quality feeds with agro-industrial by-products enables them to perform well due to higher nutrient density to correct the nutrient deficiencies in the basal diet.

## CONCLUSIONS

This paper reviewed cattle husbandry practices, like breeding system, watering, healthcare, major feed resources, and constraints that has negative impact on cattle production. Crop-livestock interaction farming systems have been viewed as the poverty saving net for resource-poor rural farmers in the country where the farmers are generally poor and unable to afford conventional fertilizers for soil fertility maintenance. The potentials for increased cattle production and the productivity is proportionally lowered by various cattle management problems, prevalence of major endemic diseases, poor feeding and high stocking rate on grazing lands, lack of support services such as extension services, veterinary services, insufficient data to plan improved services and inadequate information on how to improve animal breeding, marketing, and processing .Therefore, based on the conclusion, it is strongly recommended that detailed study in different agro-ecologies of the country is imperative to investigate the productive and reproductive performance of cattle, characterization of existing breeds to ascertain the different traits that will give better performance which will help in developing future intervention, research on cattle marketing system and market related problems are commended to come up with recommendations to solve market related problems and play a vital role in helping farmers and provision of strong extension services and training on improved forage cultivation, cattle production, and management practices in the different parts of the country.

## Conflict of Interests

The authors have not declared any conflict of interests.

### REFERENCES


Abebe M, Oosting J, Fernandez-Rivera S, Van der Zijpp J (2008). Multipurpose fodder trees in the Ethiopian highlands: Farmers' preference and relationship of indigenous knowledge of feed value with laboratory indicators. Agric. Syst. 96:184-194.

Alemayehu M (2002). Forage Production in Ethiopia: A case study with implications for livestock production. Ethiopian Society of Animal Production (ESAP), Addis Ababa, Ethiopia. P 106.

Alemayehu M (2004). Rangelands Biodiversity: Concepts, Approaches, and the Way Forward. Addis Ababa, Ethiopia.

Alemayehu M (2005). Feed resources base of Ethiopia: Status and opportunities for integrated development. Proceedings of the 12th Annual Conference of the Ethiopian Society of Animal Production (ESAP). Addis Ababa, Ethiopia. pp. 377-386.

Alemayehu M (2006). Country Pasture/Forage Resource Profiles: Ethiopia.

Alemu Y, Zinash S, Seyoum B (1991). The Potential of Crop Residues and Agro-Industrial By-Products as Animal feed. In: Proceedings of ESAP, 3rd National Improvement Conference, 24-26 May 1989. IAR, Addis Ababa, Ethiopia. pp. 57-63.

Andualem T, Berhan T, Gebeyehu G, Ermias B (2015). Characterization of cattle husbandry practices in Essera Woreda, Dawuro Zone, Southern Ethiopia. Afr. J. Agric. Res. 10(34):3421-3435.

Ayele S, Assegid W, Belachew H, Jabbar A, Ahmed M (2003). Livestock marketing in Ethiopia: A review of structure, performance and development initiatives. Socio-economic and Policy Research Working Paper 52. ILRI (International Livestock Research Institute), Nairobi, Kenya. P 35.

Aynalem H, Workneh A, Noah K, Tadele D, Azage T (2011). Breeding strategy to improve Ethiopian Boran cattle for meat and milk production. IPMS (Improving Productivity and Market Success) of Ethiopian Farmers Project. Working Paper No. 26. ILRI (International Livestock Research Institute), Nairobi, Kenya.

Azage T (2004). Urban livestock production and gender in Addis Ababa. ILRI (International Livestock Research Institute). Addis Ababa, Ethiopia. Urban Agric. Mag. 12:3.

Azage T, Berhanu G, Dirk H, Berhanu B, Yoseph M (2013). Smallholder dairy production and marketing systems in Ethiopia: IPMS experiences and opportunities for market-oriented development. Improving Productivity and Market Success of Ethiopian Farmers Project (IPMS) International Livestock Research Institute (ILRI), Addis Ababa, Ethiopia. pp. 14-15, 17, 22.

Befekadu D, Birhanu N (2000). Annual report on the Ethiopian economy. Volume 1. The Ethiopian Economics Association, Addis Ababa, Ethiopia. P 429.

Bruke Y, Tafesse M (2000). Pastoralism and Agro-pastoralism: past and present. In: Pastoralism and Agro-pastoralism which way forward? Proceedings of the 8th Annual Conference of the Ethiopian Society of Animal Production (ESAP) held in Addis Ababa, Ethiopia.

CSA (2008). Livestock and Livestock Characteristics, Agricultural sample Survey. Statistical Bulletin, 2(446):188.

CSA (2009). Federal Democratic Republic of Ethiopia, Agricultural Sample Survey. Addis Ababa, Ethiopia.

CSA (2011). Agricultural sample survey. Volume II report on livestock and livestock characteristics.

EARO (Ethiopian Agricultural Research Organization) (2001). Feeds and nutrition research strategy. EARO (Ethiopian Agricultural Research Organization), Addis Ababa. P 40.

FAO (2005). Production Year Book. FAO, Rome, Italy.
Heffernan C (2004). Livestock and the Poor: Issues in poverty focused livestock development. In: Responding to the Livestock Revolution: the role of globalization and implications for poverty alleviation. University of Reading, Reading, United Kingdom. Brit. Soc. Anim. Sci. P 33.
Ibrahim H, Olaloku E (2002). Improving cattle for milk, meat and traction. ILRI (International Livestock Research Institute), Nairobi, Kenya. ILRI, Manual 4:135.
IGAD-LPI (2011). (Inter-Governmental Authority on Development-Livestock Policy Initiative). The Contribution of Livestock to the Ethiopian Economy Part I.
IPS (International Project Service) (2000). Resource potential assessment and project identification study of the Somalia Region: Socio-economic assessment. Investment office of the Somalia Regional State. Research Report. 3:51.
Kedija H (2008). Characterization of milk production system and opportunity for market orientation: A Case Study of Mieso District, Oromia Region, Ethiopia. M.Sc. Thesis, Haramaya University, Ethiopia.
Melaku T (2011). Oxenization versus Tractorization: Options and Constraints for Ethiopian Framing System. Int. J. Sustainab. Agric. 3(1):11-20.
Mohammed H, Mengistu N, Getachew H, Kemal H, Reta H (2007). Livestock Marketing System Study in Pastoral and Agro-pastoral Communities of the Borena and Guji zones. Yabello Pastoral and Dry land Agricultural Research Center. Socioeconomic and Extension Research Division.
New Partnership for Africa's Development -Comprehensive Africa Agriculture Development Programme (NEPAD- CAADP) (2005). Ethiopia: Investment Project Profile "Live Animal and Meat Export" Preliminary Options Outline. P 3.
Pagot J (1992). Animal Production in the Tropics and Subtropics. CTA. Hong Kong. 517 p.
Solomon A, Alemu Y (2009). Shelters and housing for sheep and goats. In: Merkel RC (Eds), 32nd Technical Bulletin. Addis Ababa, Ethiopia. pp. 1-2.
Solomon B (2004). Assessment of livestock production system and feed resource base in Sinana Dinsho District of Bale highlands, South East Oromiya. M.Sc. Thesis presented to the School of graduate studies of Alemaya University of Agriculture. P 141.
Tafesse M (2001). What should a pastoralist development strategy continue towards poverty reduction among pastoral communities in Ethiopia. In: Proceedings of the 2nd Annual Conference on Pastoral development in Ethiopia. Pastoral Forum in Ethiopia, May 22-23, Addis Ababa, Ethiopia. P 136.
Tedonkeng PE, Pieper D (2000). Introduction to range Management in free and open access environments of Sub-Saharan Africa.
Ulfina G, Zelalem B, Jemal D, Gemeda D, Chala M, Jiregna D, Diriba G, Lemma G, Workneh A and Adam D (2005). Survey of cattle production and marketing practices in Danno District, Western Ethiopia, using PRA tools. PRA Report.
Vercoe E (1999). Climatic and environmental factors affecting dairy productivity. In: Falvey L, Chantalakhana C (Eds.), Smallholder Dairying in the Tropics. ILRI (International Livestock Research Institute), Nairobi, Kenya.
Workneh A, Rowlands J (2004). Design, execution and analysis of the livestock breed survey in Oromiya regional State, Ethiopia. OADB (Oromia Agricultural Development Bureau), Addis Ababa, Ethiopia, and ILRI (International Livestock Research Institute), Nairobi, Kenya. P 260.
Zinash S (2004). Livestock Production System. Short-term course in Awassa University. Awassa, Ethiopia. P 47.
Zinash S, Seyoum B (1991). Utilization of feed resources and feeding systems in the central zone of Ethiopia. Proceedings of the 3rd National Livestock Improvement Conference, Addis Ababa, Ethiopia. pp. 129-132.