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Review on Dairy Cattle Reproductive Performance Under Different Production System in Ethiopia

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ABSTRACT

Reproductive performance of dairy cattle in terms of age at first service (AFS), age at first calving (AFC), calving interval (CI), day open (DO) and number of service per conception (NSPC) in different production system in Ethiopia was reviewed. The reproductive performance parameter of dairy cattle like age at first serves (AFS), age at first calving (AFC), calving interval (CI), Day opens (DO) and number of service per conception (NSPC) under different production system is quite different. Age at first calving (AFC) in pastoral and agro-pastoral and intensive dairy production system were 43.5±1.5months and 33.2 months, respectively. Days open (DO) in pastoral and agro-pastoral, small holder dairy production and urban and dairy production for local cows were 141±7 days, 185±51.2days and 199.8±11.60 days, respectively. 85 to 115days considered as optimum for dairy herd, 116 to 130 days indicate slight problem, 131 to 145 days moderate problems. Thus, indicated that days open in different production system is not with in normal range. Similarly, for cross dairy cows in intensive dairy production system was157.8 days. The calving interval (CI) was in pastoral and agro-pastoral, small holder dairy production system, urban and pre-urban for local breed were 14.63±10 months, 14.36± 1.03 months and 22.17±0.79 months, respectively. Whereas in urban and pre-urban and intensive dairy production for cross dairy cows were12.42±5.9 months, 15.820±.41months and 14.56 months, respectively. NSPC for Horro x Jersey (1.8) and Horro (2.1) are not with in normal range, But for Borana (1.6), Fogera (1.28), Friesian x Zebu (1.56) was with in normal range. This difference might be due to poor management in terms of nutrition, health care, housing, heat detection, timely insemination and breed as well as environmental factors. It could be concluded that proper management in terms of nutrition, health care, housing, heat detection, timely insemination would improve reproductive performance under different production system. Beside this, too boost dairy cattle reproductive performance, intensification of dairy cattle production should be promoted in Ethiopia to meet increasing demand for dairy products and to reduce imports of dairy commodities. Thus, all coordinated works of all concerned bodies should be in place to boost the production and productivity and thereby enhance the livelihood of the dairy farmers

INTRODUCTION

Ethiopia is known for its huge cattle population and livestock sector contributes significantly to the National economy but unfortunately, production per animal is extremely low. It is one of the sub-Saharan Africa with a large potential for cattle production. The country is 1st among African countries and 9th in the world by possessing cattle population. The total cattle population for the country is estimated to be about 60.39 million. Out of this total cattle population, the female cattle constitute about 54.68% (CSA, 2018). The average lactation length per cow at country level is estimated to be about six months, and average milk yield per cow per day is about 1.37 liters (CSA, 2018).

Livestock production plays important role to human health and poverty alleviation in Ethiopia. The cattle production gives multi-purpose role where cattle provide milk, meat, fertilizer, fuel, draft power and also as a means of economic uplift from the sale of milk and milk products. The sector contributes 15 to 17% of gross domestic product (GDP) and 35 to 49% of agricultural GDP and 37 to 87% of the household incomes (Behnke and Metaferia, 2011).

There are five production systems that have been identified based on the integration of livestock with crop production, the level of input and intensity of production, agro-ecology, and market orientation. These are Pastoral (traditional pastoral livestock farming), Agro-pastoral (Traditional lowland mixed livestock farming), the mixed crop-livestock system (traditional highland mixed farming), Urban and Peri-urban (the emerging smallholder dairy farming) and Commercial (specialized commercial intensive dairy farming) (FAO, 2011).

Pastoral systems are mainly found in the lowlands where livestock production is the dominant form of production to sustain the livelihood of pastoral society with no cropping, while agro pastoral system combines both cropping and livestock production. In both systems, the production is based entirely on low input, with low milk yield, and little market orientation (Tegegne et al., 2013).One measure of productivity is reproductive performance. Reproductive and productive performance is vital for the profitability of many animal production systems. Especially, the economics of dairy enterprise is based on an efficient reproductive and performance of dairy animals (Nibret, 2012).

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In Ethiopia, the poor genetic potential for productive traits, substandard feeding, poor health care and management practices are the main contributors to low productivity (Belay et al., 2012). The reproductive performance of dairy cows is the most important factor that is a prerequisite for sustainable dairy production system and influencing the productivity. This review would support researchers to understand more about the reproductive performance parameters and different production system under Ethiopian condition. The review paper provides information to dairy producers and breeders regarding to reproductive performances of dairy cattle under different production system. Therefore, the objectives of this review paper were to highlight the overall reproductive performance of dairy cattle under different production system in Ethiopian.

Different dairy production systems Ethiopian

Dairy cattle production systems already existing in Ethiopia is part of four major livestock production systems: Specialized commercial dairy production systems, pastoral and agro– pastoral production, rural smallholder (mixed crop– livestock) production and urban and peri-urban smallholder dairy production. Milk, with little or no land resources, only making use of the human and capital resources made available mainly for specialized dairy production under stall feeding conditions (Azage et al., 2013)

The Ethiopian dairy production system is based on predominantly indigenous zebu cattle, which is well adapted to and distributed among the diverse ecological conditions and management systems of the country. Although no exhaustive identification and characterization work has been conducted, it is suggested that there are over 25 types/breeds of indigenous cattle, the most popular ones including Boran, Horro, Fogera, Arsi, Karayu and Nuer (IBC, 2004).

Pastoral and Agro-Pastoral

Pastoralists raise about 30% of the indigenous livestock population which serve as the major milk production system for an estimated 10% of the country's human population living in the lowland areas. Milk production in Pastoral and agro-Pastoral system is characterized by low yield and seasonal availability (Zegeye, 2003)

Pastoral and agro-pastoral production system is the major milk production practiced in the lowland regions of Ethiopia where livelihoods are heavily dependent on livestock. Cattle dominate the livestock population followed by camel, goats, and sheep. Major pastoral areas extend from the north-eastern and eastern lowlands (Afar and Somali) to the southern and south-western lowlands (FAO, 2017). In pastoral and agro-pastoral areas shorter calving intervals of 15.5 months than 19 months, respectively (Workneh and Rowland, 2004).

Peri-Urban and Urban Production system

Peri- Urban livestock keeping fits different livelihood strategies and contributes to food security, income and employment generation, saving and insurance (Azage et al., 2006). Peri-urban dairy systems are located mainly in rural areas or at the edge of the urban areas having relatively better access to urban centers in which dairy products are highly needed (Azage et al., 2013).

Urban and peri-urban being market oriented systems emerge as a significant part of milk production systems in Ethiopia. Food and nutrition, increased income, employment generation, organic waste recycling and uplifting social status are known to be the most important benefits (Gillah et al., 2012). Urban and peri-urban systems are intensified through the use of crossbred dairy cows, purchased and conserved feed and stall-feeding (Azage et al., 2010).

Urban and peri-urban being market oriented systems emerge as a significant part of milk production systems in Ethiopia. Food and nutrition, increased income, employment generation, organic waste recycling and uplifting social status are known to be the most important benefits (Gillah et al., 2012). Urban and peri-urban systems are intensified through the use of crossbred dairy cows, purchased and conserved feed and stall-feeding (Azage et al., 2010). The main feed resources are agro industrial by products and purchased roughages. The system comprises small and medium sized dairy farms that own crossbred dairy cows. Farmers use all or part of their land for forage production (Azage et al., 2000)

The urban and peri-urban dairy production system is an expanding production system, largely found in the highlands and is concentrated in the Addis Ababa milk shed area as well as around the regional capital cities where an adequate market for fresh milk is readily available. It is practiced by many landless urban and suburban poor households. However, some businessmen and retired civil servants also keep some dairy animals depending, wholly or partly, on hired labor. Producers are market oriented and respond to improved technical, input supply and marketing services (Bogale et al., 2014).The main feed resources are agro-industrial by-products, purchased roughage, crop residue and pasture land. The primary objective of milk production is generating additional cash income (Aneteneh et al., 2010)

Mixed crop–livestock Dairy production system

Mixed crop–livestock dairy production is a subsistence-oriented farming system concentrated in the mid- and high-altitude agro-ecological zones where cereals and cash crops are dominant farm activities. Cattle are primarily kept to supply draft power needed for crop production. However, milk production is an integral part of the production system. The bulk of the total milk produced nationally and about three quarters of the liquid milk processed commercially (FAO, 2019)

Natural pasture, crop residues, and weeds and crop thinning are the major feed types. The management style is mostly low-input, low-output traditional extensive system. About 65 percent of the total milking cows are

found in this system and produce about 72 percent of the national annual milk output (FAO and NZAGRC, 2017). Water is sourced from rivers and rainwater. Housing type can be open kraal, partition within family house or share the same room with humans. Milk yield per cow is 1.9 liters per day, on average (Felleke et al., 2010).

Milk production in this production system depends largely on indigenous breeds and small amount in cross breeds of cattle. Therefore, most of the milking cows are indigenous animals with low production performance with an average age of first calving being 53 months while 25 months for average calving intervals. In the farming system, feed requirements are got from native pasture with supplement from crop residues and stub grazing (Afras, 2018).

Dairy production in the mixed crop-livestock system is pivotal to supplying the bulk of milk and milk products to the Ethiopian population although it is not essentially market-oriented. Smallholder farmers either sell excess milk informally to individual consumers and milk collectors or process it into butter and cottage cheese for sale. Productivity per unit of land and per head of animal is extremely low. At the same time, poor service delivery systems, particularly veterinary services, make it prone to disease outbreaks and losses due to mortality and morbidity (FAO, 2019)

Intensive Dairy production System

Intensive dairy productions systems are located in and around Addis Ababa and basically keep high grade or purebred dairy stock (Azage et al., 2000). The commercial farms are small- to large-scale dairy farms, the large-scale farms being concentrated in and around Addis Ababa. The herd is dominated with improved/cross breed dairy cattle and the production system is market oriented and milk production is for sale (surplus production) (Ahmed et al., 2003)

The exact number of commercial dairy farms is not known but they represent a small fraction of total dairy farmers. The number of dairy cows in this system, however, is steadily growing and is estimated at ~3 percent of the total national milking cows. Geographically, they are concentrated mainly in the central highlands near major cities and towns. Average herd sizes can be more than 100 milking cows for large-scale farms; 30–100 for medium-scale and <30 for small-scale farms (FAO, 2019).Driven by the unprecedented increase in demand for milk and other dairy products, commercial dairy is a growing sub-system in Ethiopia. However, it is constrained by shortage of inputs particularly feed, genotypes, and veterinary services. Most commercial farmers are obliged to process the milk they produce into various dairy products but not all have the financial and infrastructural capabilities to meet such obligations (Shapiro et al., 2015; FAO, 2017)

The specialized commercial dairy systems involving higher levels of investment are concentrated in the central highland plateau. In terms of scale of operation, the farms are classified as large-, small- or medium-scale. Being licensed farms with operational business plans, they are market oriented specifically targeting consumers in urban areas. Producers tend to have a good understanding of dairy management. The commercial dairy system is labor and input intensive relative to other systems. The animals do not provide draft power but their manure is used as fertilizer (FAO, 2019)

Major feed types include hay, concentrated dairy mix, and industrial by-products. These are mainly purchased, though some farms cultivate own pasture. Main water source is tap or boreholes. Common animal health problems include mastitis, infertility, and bovine tuberculosis. These farms have access to vaccination, treatment and deworming services. Standard dairy housing or simple shelter may be used. Productive and reproductive performances are usually better with daily milk yield in the range of 15–20 liters per cows and an average lactation yield of about 4,375 liters (FAO, 2019)

In general, the reproductive performance of dairy cattle under different production system was depicted Table 1.From this table age at first calving (AFC) in pastoral and agro-pastoral and intensive dairy production were 43.5±1.5 and 33.2, respectively. Number of services pericon ception (NSPC) in pastoral and agro-pastoral, small dairy production and intensive dairy production system are not with in normal range. NSPC 1.3 to 1.7 regarded as normal at national level. However, from (Table 1) except urban and per-urban dairy production which fall with in normal range and the three-production system are out of the stranded.

The days open (DO) in pastoral and agro-pastoral, small holder dairy production and urban and dairy production for local cows were 141±7, 185 ±51.2 and 199.8±11.60, respectively. In contrary, Tadesse et al. (2010) reported that 85 to 115days considered as optimum for dairy herd, 116 to 130 indicate slight problem, 131 to 145 moderate problems. Similarly, for cross dairy cow's day open in intensive dairy production system was157.8. Thus, indicated that the day open in different production system was not with in normal range.

The calving intervals (CI) in pastoral and agro-pastoral, small holder dairy production system, urban and pre-urban for local cows were 14.63 ± 10, 14.36± 1.03 and 22.17± 0.79, respectively. Whereas in urban and pre-urban and intensive dairy production system for cross dairy cows were 12.42±5.9, 15.820±.41 and 14.56, respectively. The difference might be due to poor management in terms of nutrition, health care, housing, heat detection, timely insemination as well as environmental factors in all production system.

Reproductive performance of dairy cattle in Ethiopia

Reproductive traits describe the animal's ability to conceive, calve down and suckle the calf to weaning successfully (Davis, 1993). Reproductive efficiency of a herd is an important component of dairy cattle productivity in the world. Economic losses because of poor fertility can be attributed to the cost of prolonged calving interval,

Table 1: Reproductive performance of dairy cattle under different production system

Production system	Agro-E	Breed	Reproductive performance of dairy cattle					Reference
			AFS(M)	AFC(M)	CI(M)	DO (D)	NSPC	
PAGro	LL	L	32.4± 1.4	43.5± 1.5	14.63±10	141 ± 7	2.44±0.1	Aynalem etal.(2011)
SHDP	HL	L	-	39.4 ±1.7	14.36± 1.03	185 +51.2	2.1+0.1	Niraj et al.(2014)
UPRE	ML	CR	24.9±3.8	34.8±4	12.42±5.9	85.6±5.6	1.52±0.9	Hunduma (2012)
	ML	L	41.621±.63	51.98+1.45	22.17± 0.79	199.8+11.60	1.34± 0.28	Belay et al.(2016)
	ML	CR	24.19± 1.	34.78± 1.08	15.820±.41	100.75+6.99	2.100±.17	Belay et al.(2016)
IDP	HL	CR	22.76	33.2	14.56	157.8	1.93	Zenebe etal. (2016)

Where PAGro =Pastoral agro-pastoral, SHDP=Small holder dairy production, UPRE=Urban and pre-urban dairy production, IDP= Intensive dairy production, L=Local cows, CR=cross dairy cows, LL=Low land, HL=Highland, ML=Midland, Agro-Ecology, M=Months, D=days

increased insemination costs, reduced returns from calves born and forced replacements in the event of culling. A delay in conception because of poor fertility increases calving interval mostly due to the increase in the number of days from calving to conception (Nishida et al., 2006). The productivity of dairy cattle breeds depends mainly on their reproductive performance and efficiency of service per conception. Reproductive performance is a characteristic of outstanding importance in dairy cattle business (Gabriel et al., 1983).Reproductive performance parameters are age at first service, age at first calving, number of services per-conception, calving interval, and days open are the bases of profitable production for dairy farm (Mukasa,1989). Reproductive efficiency of dairy cows is influenced by different factors including genetic, season, age, production system, nutrition, management, environment and disease (Belay et al., 2012)

Age at first service

Age at first services (AFS) is the age at which heifers attain body condition and sexual maturity for accepting service for the first time (Gidey, 2001).Assefa et al. (2015) reported that the average age at first service was 40.74 months for heifers of indigenous breed and the average effective age service of local bull is 44.4 months in Sidama zone southern Ethiopia. Nuraddis et al. (2011) reported that the mean AFS for crossbred dairy cows (Holstein Frisian X zebu) in urban and peri-urban production system in Gondar town was 23.2 months. Belay et al. (2012), Hunduma (2012) and Emebet (2006) reported that 24.3, 24.9 and 24.1months age at first service for cross breed dairy cows under small scale dairy production system in Jimma, Asella, Dire Dawa, respectively

Table 2: Average age at first service of indigenous and crossbred dairy cattle

Breed	Location	Age at first Maturity(months)	Sources
Horro	Ethiopia	46 male and 48 females	Mekonnen et al. (2012)
Native	Ethiopia	40.74 female and 44.4 male	Assefa et al. (2015)
Horro x jersey	Ethiopia	33	Damissu et al. (2013)
Friesian x Fogera	Ethiopia	36.8	Gebeyehu et al. (2005)
Friesian x Zebu	Ethiopia	24.3	Belay et al. (2012)

Table 3: Average age at first Calving (AFC) of Zebu and crossbred dairy cattle

Breed	Location	Age at first calving(month)	Sources
Horro	Ethiopia	58.08	Makonnen et al. (2012)
Fogera	Ethiopia	50.8	Menale et al. (2011)
Begait	Ethiopia	60	Rege et al. (2006)
Cross bred	Ethiopia	34.8	Hunduma (2012)
Cross bred (HF x Zebu)	Ethiopia	36.4	Belay et al. (2012)
Jersey cows	Ethiopia	34.5	Habtamu et al. (2010)
Horro x Jersey	Ethiopia	42.2	Damissu et al. (2013)
Holstein–Friesian	Ethiopia	561	Amene et al. (2011)

Age at first calving (AFC)

The age at first calving is the age when an individual calf gives birth for the first time. First calving characterizes the start of the productive life of a cow having an influence on both reproductive and productive life of the female, directly having an effect on her lifetime calf crop and milk production, and indirectly through its influence on the cost that has been invested for the upbringing (Azage et al., 2011).

First calving makes the beginning of a cow productive life and influences both the production and reproduction life of the female, directly through its effect on her life

time calf crop and milk production and indirectly it is influence on the cost invested (Mukasa- Mugerwa, 1989). Under controlled breeding system, heifers are usually mated when they are mature enough to withstand the stress of parturition and lactation. It is recommended that heifers calve between 23 and 25 months of age, which is considered as optimum that increase profitability of the dairy business (Hammoud et al., 2010).Nuraddis et al. (2011) and Hunduma (2012) reported mean AFC of 34.7 months and 34.8 months for crossbred dairy cows in Gonder and Asella towns, respectively. Belay et al. (2012) reported 36.4 months of AFC for crossbred (HF x Zebu) cows under small scale dairy farms in Jimma town. Tadesse et al. (2010) reported 39.2 months for Holstein Frisian (HF) cows under intensive production system in central highland Ethiopia.

Calving interval (CI)

Calving interval (CI) refers to the period between two consecutive calving expressed in days or months (Gidey, 2001). It is probably the best indicator of a cow's reproductive efficiency and expresses the economic importance of reproduction. Twelve months calving interval is generally considered the most economically desirable period for dairy cows. However, such a standard lactation length might not work for smallholder dairy cows in which the lactation length is extended considerably in most cases (Msangi et al., 2005).

Relatively longer calving interval might be indicative of poor nutritional status, poor breeding management, lack of own bull and artificial insemination service, longer days open, diseases and poor management practices (Belay et al., 2012). In pastoral and agro-pastoral areas shorter calving intervals of 15.5 months than 19 months, respectively have been reported (Workneh and Rowland, 2004).

Calving intervals do have low heritability and this can be enhanced through early breeding and nutrition (Mulugeta and Belayneh, 2013). This is important to the breeders because the lowest calving interval result the highest lifetime for calf production. One of the major problems that affect the lifetime productivity of dairy herds is extended calving interval (Belay et al., 2012).

Table 4: Average calving interval in days

Breed	Location	(CI) calving interval in month	Sources
Borana	Ethiopia	20.73	Yifat et al. (2012)
Begait	Ethiopia	15.26	Rege et al. (2006)
Fogera	Ethiopia	17.5	Rege et al. (2006)
Horro	Ethiopia	17.56	Rege et al. (2006)
Arsi	Ethiopia	14.63	Gabriel et al. (1983)
Jersey cows	Ethiopia	15	Habtamu et al. (2010)
Crossbred dairy cows	Ethiopia	12.4	Belay et al. (2012
Zebu X Holstein-Friesian	Ethiopia	21.33	Belay et al. (2012
Holstein–Friesian	Ethiopia	518.7	Amene et al. (2011)

Table 5: DO of indigenous Zebu and cross breed cattle

Breed	Location	(DO)Days open in days	Sources
Horro (Zebu)	Ethiopia	134	Gizaw et al. (2011
Horro x Jersey	Ethiopia	109	Gizaw et al. (2011
Friesian X zebu cattle	Ethiopia	87	Nibret (2012)

Day open

Days open (also called calving-to-conception interval) is the period between calving and conception in cows (Tewodros, 2008). Days open is influenced by the length of time for the uterus to completely involutes, resumption of normal ovarian cycle, occurrence of silent ovulation, accuracy of heat detection, management, semen quality and skill of inseminator or efficiency of bull (Melaku et al., 2011).

According to Gebeyehu et al. (2007) and Tadesse et al. (2010) a herd average of less than 85 open days indicates that cows are being breed early, 85 to 115days considered as optimum for dairy herd, 116 to 130 indicate slight problem, 131 to 145 moderate problems, while more than open days considered as sever reproductive problem in the dairy herd. Reproductive parameter is influenced by Feed shortage, silent estrus and lack of proper heat detection might have contributed considerably to the long days open (Belay et al., 2012). From (table:5) it is indicated that day opens for Horro, Horro x Jersey, Friesian x zebu cattle were 134 days,109days, 87 days, respectively. Thus, might be due to breed and production system .85 to 115days open considered as optimum for dairy herd, 116 to 130 indicate slight problem, 131 to 145 moderate problems (Tadesse et al., 2010)

Number of services per conception (NSPC)

The total number of services per conception is known to be the number of services/inseminations needed for a conception to be successful (Menale et al.,2011). Number of services required for conception (NSPC) is one factor considered in determining reproductive efficiency of cow. It is reflecting the efficiency of management. The differences could be attributed to differences in management practices and agro-ecology of the respective areas. Appropriate and in time heat detection and insemination could be attributed to lower or higher number of services of per conception (Yifat et al., 2009).

Table 6: NSPC of indigenous Zebu and cross breed cattle

Breed	Location	NSPC	Sources
Native	Ethiopia	2.2	Kumar et al. (2014)
Horro	Ethiopia	2.1	Damissu et al. (2013)
Borana	Ethiopia	1.6	Yifat et al. (2012)
Fogera	Ethiopia	1.28	Menale et al. (2011)
Horro-Jersey	Ethiopia	1.8	Damissu et al. (2013)

According to the authors number of services per conception depends largely on the breeding system used. It is higher under uncontrolled, natural breeding than hand mating and Artificial Insemination (AI) and Values of NSPC greater than 2 should be regarded as poor (Mukasa- Mugerwa, 1989).The NSC was significantly affected by herd, season, placenta expulsion time, lactation length and milk yield (Abdel and Alemam, 2008). Belay et al. (2012), Gebeyehu et al. (2005) and Demeke et al. (2004) reported 1.56, 1.62 and 1.73 NSPC for cross breeds in Jimma, Andassa ranch and Holeta Research Center Ethiopia, respectively

In summary, NSPC for native (2.2), Horro- Jersey (1.8) and Horro (2.1) are not with in normal range. However, for Borana (1.6), Fogera (1.28), Friesian x Zebu (1.56) was with in normal range. According to the authors number of services per conception between 1.3 and 1.7 is considered as normal range. This might be due to different breeding system and it is higher under uncontrolled, natural breeding than hand mating and Artificial Insemination (AI) and Values of NSPC greater than 2 should be regarded as poor.Therefore, the number of NSPC for native 2.2 and Horro (2.1) is poor as compared to other.

CONCLUSION AND RECOMMENDATION

Reproductive performance of dairy cattle under different production system was reviewed. The reproductive performance parameter of dairy cattle like age at first serves (AFS), age at first calving (AFC), calving interval (CI), Day opens (DO) and number of service per conception (NSPC) under different production system is quite different. Age at first calving (AFC) in pastoral and agro-pastoral and intensive dairy production system were 43.5±1.5months and 33.2 months, respectively. Days open (DO) in pastoral and agro-pastoral, small holder dairy production and urban and dairy production for local cows were 141±7 days, 185±51.2days and 199.8±11.60 days, respectively. Similarly, for cross dairy cows in intensive dairy production system was157.8 days.85 to 115days considered as optimum for dairy herd, 116 to 130 days indicate slight problem, 131 to 145 days moderate problems. Thus, indicated that days open is different in all production system. The calving interval (CI) were in pastoral and agro-pastoral, small holder dairy production system, urban and pre-urban for local cows were 14.63±10 months, 14.36± 1.03 months and 22.17± 0.79 months, respectively. Whereas in urban and pre-urban and intensive dairy production for cross dairy cows were 12.42±5.9 months, 15.820±.41months and 14.56 months, respectively. NSPC for Horro x Jersey (1.8) and Horro (2.1) are not with in normal range, But for Borana dairy cows (1.6), Fogera (1.28), Friesian x Zebu (1.56) were with in normal range. The difference might be due to poor management in terms of nutrition, health care, housing, heat detection, timely insemination and breed as well as environmental factors. It could be concluded that proper management in terms of nutrition, health care, housing, heat detection, timely insemination would improve reproductive performance under different production system. Thus, coordinated works of all concerned bodies should be in place to boost the production and productivity and thereby enhance the livelihood of the dairy farmers. Based on the above conclusion the following the recommendation were forwarded

- To improve the reproductive performance of dairy cows under different production there should be improved nutrition, Proper heat detection, health care, timely insemination
- There should be proper management of postpartum reproductive problems, early growth of heifers and use new reproductive technology.
- To minimize voluntary waiting period after calving, establish well planned breeding policy and standard record keeping practice should be applied.

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