A Review on Dairy Cattle Breeding Practices in Ethiopia

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Abstract
This paper was aimed to review and indicate dairy cattle breeding practices including mating system, breeding objectives, traditional selection practice of farmers, reproduction, estrus detection and time of insemination and the gaps that exist in Ethiopia. There is no such a satisfactory cattle’s breeding system and reproduction performance in the country in general and particularly at the farmers’ level. More farmers practiced natural, unplanned and uncontrolled mating system. Communal grazing land is the main source of breeding bull in most part of Ethiopia with exception of few AI service. Therefore, in Ethiopia, there is a need to use breeding objectives in line with vibrant and effective breeding policies for both AI and natural service for sustainable and effective animal breeding practice. Besides, breeding records such as breeding dates, pregnancy rates and days to first service used to monitor fertility are other advantages of breeding practices that should be given attention. Equally, importance, genetic conservation should not be underestimated in improving dairy cattle. In conclusion, animal breeders, policy designers and any development practitioners have to give due attention to transform the existing agrarian breeding practices targeting towards dairy productivity and production with careful consideration of genetic conservation of local cattle breeds.

Keywords: Breeding Practice; Dairy Cattle; Ethiopia

INTRODUCTION
Dairy cattle and livestock make an essential contribution to agriculture, food and rural development. They provide products and services such as milk, meat, draught power and manure for fertilizers and fuel (FAO, 2010; Mekonen et al., 2012). Dairy farming is seen as one of the few agricultural activities that can provide enough income to maintain the economic viability of smallholder farms (Staal et al., 1996), and it has the potential to generate income and employment in order to improve the welfare of smallholders (Walshe et al., 1991).

Smallholders in tropical countries do have a broad perspective of dairy production and need effective livestock genetic improvement programs to advance their livelihood (Bebe et al., 2003). In order to develop the genetic disposition of the animals, selection and breeding methods can be used (Raganitsch et al., 1990, Willam and Simianer 2011). Breeding methods distinguished in to pure breeding and crossbreeding systems (Willam and Simianer, 2011). In order to frame sustained genetic improvement programs it is necessary to know which breeds the farmers consider most suitable for their environment, their perceptions of breed attributes and the factors that affect their breeding decisions (Bebe et al., 2003).

In dairy cattle breeding, most of the dairy farmers in the highland, midland and the lowland areas of Ethiopia used natural mating by using indigenous breeding bull (Tesfà, 2009). Along with natural mating, some farmers used AI in highland and midland areas. Some of the farmers also preferred seasons for mating for their dairy cattle. They mate their cows in such a way that the calving falls during the wet season to take the advantage of abundant feed supply which promotes better milk production and hence a better chance of survival of calf (Tesfà, 2009). With perspectives of livestock production in Ethiopia, this paper aimed in reviewing the trained of dairy cattle breeding practices, breeding objectives, selection methods, trait preference, mating practices, culling mechanisms and constraints of breeding practices.

Breeding Objectives
Breeding objective is defined as the reason (s) for which animals are specifically bred for, it assumes that the farmers have made a deliberate choice to genetically improve the next generation of animals in terms of their performance in relation to their parent generations (Godadaw et al., 2014). The breeding objective in any livestock species is to increase profit by improving production efficiency (Charfeddine, 2000). Similarly, Piotr et al. (2004) also reported that the cattle-breeding objectives were focused on the enhancement of milk yield, under the assumption that profit would increase with increase in milk yield per cow. According to Zewidu (2004) and Godadaw et al. (2014), the first important breeding objective by the farmers in North Amhara region was obtaining better milk yield. An efficient, systematic and operational breeding strategy is necessary to bring about any substantial improvement in the dairy sector.

Breeding structures provide systems for gathering information about the assessment of animals in the production system and conditions that allow selection of parents (males and females) of the future progeny, besides the mating of these livestock in a desired manner (Van Der Werf, 2004).

Development of the dairy sector in Ethiopia as in any other developing countries can further be
augment with the selection within the local cattle besides crossbreeding (Yilma, 2011). However, any formal pedigree and performance recording systems are virtually non-existent with the livestock keepers in most of the tropical countries, thus under those condition the only option left is to select animals based on their phenotypic traits like body size, udder size etc (Bebe et al., 2003). Production circumstances have given rise to interest in directly reducing cost of production, and breeding objectives are moving from increasing yield to economic efficiency. A breeding programme must consider and address how superior animals will disseminate their genes quickly throughout the whole population.

Sustainable and effective animal genetic improvement programs need to be planned, implemented and maintained in order to accomplish a meaningful development in livestock productivity through genetic improvement (Desta, 2002). From the dairy farmer's point of view, the first breeding objective is efficient reproduction (e.g. short calving intervals and regular lactations) and the long-term breeding objective is the genetic improvement related to market and production conditions (Walshe et al., 1991).

In most of the countries in the tropics, both AI and natural service are practiced as methods of breeding. For effective breeding practice, one should consider techniques and options of improving the genetic performance of cattle. In most of the tropical countries, smallholder dairy farming is predominant (Walshe et al., 1991, Devendra 2001). Smallholder farmers do have a broad perspective to dairy production and pursue several breeding objectives such as increase of milk production, adaptability of animals to local feed conditions and diseases, manure production and cattle as capital assets (Kahi et al., 2000). Moreover, farmers in various cattle production systems have different trait preferences and breeding strategies that need an investigation before designing any sustainable breeding plan (Mwambene et al., 2012). In Northern Ethiopia, Arado cattle keepers consider draught ability, disease and heat resistance as important attributes of this breed and practice uncontrolled mating of the animals (Genzebu et al., 2012). Jiregna (2007) indicated primary criteria used to select breeding bulls in Danno district were body height, body size, body length, body condition, physical appearance, coat color, hump size, prepuce sheath, temperament, body conformation (shape), horn size and potential for traction use for the same breed Horro cattle.

Marketable traits such as milk yield, growth rate and reproductive performances and non-marketable traits such as draught power output, coat color and adaptability, practice pure breeding and have developed a culling mechanism for maintaining the desired quality of their animals (Ayantu et al., 2012). In Southwestern Ethiopia, Sheko cattle breeders consider milk production, fertility (age at first calving, calving interval and lifetime calf crop) and traction as the most important attributes of the breed. In addition, natural and non-selective mating is practiced and results in a non-descript herd structure (Taye et al., 2010).

Breeding Policies

The genotype of crossbred animals kept by producers is likely to include any percentage of foreign genetic material due to unsystematic breeding practices, unplanned mating schemes, uncontrolled AI services and bull distribution. Crosscutting threats include lack of awareness of the significance of AnGR among decision-makers and lack of consultation with livestock keepers and other relevant stakeholders (FAO, 2009), both of which contribute too many threats arise because of policy and management decisions. Designing of a breeding program also needs to take into consideration a mechanism that ensures conservation of animal genetic resources (Aynalem et al., 2011). However, crossbreeding was and still is perceived as “the way forward” to improve productivity of indigenous livestock under smallholder conditions and development policies has largely ignored adapted farm animal genetic resources. Moreover, no information is available on the status of the national dairy cattle genetic improvement program that guide policy makers, development planners and breeders to redesign appropriate breeding programs that respond to the current scenarios in Ethiopia (Kefena et al., 2011).

Mating system

Mating in the context of animal breeding means pairing of female and male animals for the purpose of reproduction on a farm using natural or artificial (AI) methods (Willam and Simianer, 2011). In Ethiopia, the most commonly mating methods practiced are natural and artificial methods. The natural methods use bull mating while the artificial ones employed artificial insemination (AI) system.

Natural Mating

The use of bulls for natural service remains widespread in Ethiopia (Kelay, 2002). In natural mating the bull testicles should have a distinct neck and should not be fibrotic or flaccid in consistency. This is essential because testicles must be a reasonable distance away from the internal body temperature (Jensen, 1997). Azage et al. (1997) also indicated that there is a direct relationship between scrotal circumference and semen production. Bulls should also have good body condition and have morphologically sound feet and legs and healthy eyes to perform the service properly.

As indicated in a study by Ayantu et al. (2012) and Azage et al. (2013) uncontrolled mating
Artificial Insemination (AI)

In Ethiopia, AI was first introduced in 1938 in Asmara, the then part of Ethiopia, however the process was interrupted due to the 2nd World War and restarted in 1952 (Yemane et al., 1993). It was again discontinue due to unaffordable expenses of importing semen, liquid nitrogen and other related inputs. In 1967, an independent service was again restarted in the then Arssi Region, Chilalo Awraja under the Swedish International Development Agency (SIDA).

Artificial insemination (AI) is a process in which sperm is collect from male animals and artificially introduced into the female reproductive tract for the purpose of fertilization (Ball and Peter, 2004). Artificial insemination offers several advantages over the natural service. The reason most commonly advocated is as a means of genetic improvement and others include cost effectiveness, disease control, safety breeding, flexibility, and fertility management (Ball and Peter, 2004; Holm et al., 2008). AI also plays important role to increase the yielding capacity of cows and is the appropriate and cheapest way of genetic improvement. Breeding programs has to be well organized and excited in a very reliable way and AI is fully functional when it linked with good animal husbandry such as effective heat detection (Noakes et al., 2009). Besides, the availability of accurate heat breeding records such as breeding dates, pregnancy rates, ineter-estrus intervals, and days to first service used to monitor fertility are other advantages of AI (Sinishaw, 2005). However, AI includes poor conception rate due to poor heat detection and inefficiency of AI technicians, dissemination of reproductive diseases and poor fertility rates if AI centers are not equipped with appropriate inputs and are well managed (Gebeyehu, 2005).

Number of Service Per Conception and Repeat Breeder

Number of service per conception (NSPC) is defined as the number of services/ inseminations required for a successful conception (Menale et al., 2011). It depends largely on the breeding system used and influenced by both genetic and non-genetic factors viz. season (availability of feed), semen quality and quantity and parity (Gebrekidan et al., 2012). Numbers of service per conception in some part of Ethiopia are in Table 1.

Table 1 Number of service per conception (NSPC) zebu and cross breed cattle

<table>
<thead>
<tr>
<th>Breed</th>
<th>NSPC</th>
<th>Sources</th>
</tr>
</thead>
<tbody>
<tr>
<td>Native</td>
<td>2.2</td>
<td>Kumar et al. (2014)</td>
</tr>
<tr>
<td>Horro</td>
<td>2.1</td>
<td>Demissu et al. (2014)</td>
</tr>
<tr>
<td>Fogera</td>
<td>1.28</td>
<td>Menal et al. (2011)</td>
</tr>
<tr>
<td>Horro-Jersey</td>
<td>1.8</td>
<td>Demissu et al. (2014)</td>
</tr>
<tr>
<td>Native-Friesian</td>
<td>1.56</td>
<td>Belay et al. (2012)</td>
</tr>
<tr>
<td>Eastern low lowland Crossb</td>
<td>2.2</td>
<td>Emefet (2007)</td>
</tr>
<tr>
<td>Native-Friesian</td>
<td>1.3</td>
<td>Nibret (2012)</td>
</tr>
</tbody>
</table>

Selection Practice and Traits Preference of Dairy Cattle

As it is true for many other tropical developing countries, the cattle genotypes of Ethiopia have evolved largely because of natural selection for the traits such as survivability, ruggedness, heat tolerance and tolerance for diseases and seasonal shortage of feed (Abeygunawardena and Dematewewa, 2004). Selection can be two types; man-made and natural selection. Nature selection competent animals but man selects useful animals with preferred traits. Now a day, manmade selection takes in to account both the usefulness and the survival of the animals. Jiregna (2007) indicated primary criteria used to select breeding bulls in Danno district were body height and length, body condition, physical appearance, coat color, hump size, prepuce sheath, temperament,
Body conformation (shape), horn size and potential for traction use.

Cattle keepers in Ethiopia prefer to select their herd based on marketable traits such as milk yield, growth rate and reproductive performances of the heifers/cows, steers/bulls. However, traits such as coat color and adaptability are traditionally taken into account when selecting the dairy cattle (Ayantu et al., 2012). The interventions by the modern breeders hence should take into account adaptive traits for overall improvement of the herds. Horro cattle are traditionally reared for high fat content in milk (Ayantu et al., 2012) while Kereyu cattle are preferred for high milk yield as fresh milk usually consumed by the pastoral community (Shiferaw, 2006).

Culling and Castration for Male Cattle Practices
According to Ayantu et al. (2012), farmers in Horro district have developed culling mechanism for maintaining the desired quality of their animals. The author also indicated that culling of male animal is done at age of seven years after using the animal for both draught and breeding for three years. For Bako and Horro cattle farmers use different methods to cull unproductive animals from their herd and in most cases they cull through selling, castration and slaughter (Ayantu et al., 2012, Dereje, 2015). A report by Solomon (2010) about Boran pastoralist and agro pastoralist also indicated the same method of culling of Boran cattle from the herd is employed.

Majority of farmers in North Amhara region male animal castration is common breeding management practices to make bulls tame for different farming activities, to avoid the difficulty with breeding bulls running around for mating and to remove unwanted bulls from mating (Godadaw et al., 2014). Bull castration practiced by farmers at the age of 6.78 years for different reasons of which castration to use for traction and fattening. Jirenga (2007) similarly reported that the age of castration of bulls in Danno district is about six years. On the other hand, there are reports that indicated of which castration of bull is done at 4.08 years for Mursi and 4.2 years for Borana cattle, (Endashaw, 2010; Solomon, 2010). Early castration is preferable to resist the shock of castration and to some extent the bull was contributes its genetic make up to its offspring. Castrated oxen are preferable for traction and fattening since the energy for sperm production goes to fatten the animal and for traction (Endashaw, 2010; Solomon, 2010).

Estrus Detection and Time of Insemination
Knowledge of estrus behavior and the estrus to ovulation interval is essential for estimating the best time to artificially inseminated cattle (Reolofs et al., 2010). Inaccurate estrus detection leads to delayed insemination, reduced conception rates and thus extended calving intervals (Daris, 1998). Livestock keepers visually observe the signs of estrus and thus with experience can accurately estimate the time of the standing estrus.

Findings by Miah et al. (2004) indicate that if insemination is carried out later than 22 hrs from the inception of estrus results in poor conception. A cow that is first seen in estrus in the morning is usually inseminated in the afternoon of the same day, whilst a cow seen in estrus in the afternoon is inseminated early the next day (Arthur, 2001). Time and season of insemination is the most important factors to optimize CR of the cows (Miah et al., 2004). According to Jane et al. (2009), standing heat can occur any time in a 24-hour period. However, the most likely time for a cow or heifer to show heat signs is at night but the season of the year can influence this, with more cows showing heat at night in hot weather and more showing heat during the day in cold weather. Hot weather, high production, crowded conditions, and high stress environments may reduce mounting activity. Observers must distinguish among cattle coming in to heat, in standing heat, and going out of heat. Females that are in standing heat, were in standing heat yesterday, or will be in standing heat tomorrow are the most likely herd mates to mount other cows or heifers in heat (Jane et al., 2009).

Reproductive Performance of Dairy Cattle
Reproductive performance is often a major determinant of biological and economic efficiency of livestock production in the tropics. Production of milk also depends heavily on reproductive performance of cows (Kiwuwa et al., 1983). Reproductive performance of dairy cows is influenced by different factors including gene, season, age, production system, nutrition, management, environment and diseases (Shiferaw et al., 2003). Reproductive performance traits like age at first service (AFS), Age at first calving, number of services per conception (NSC), days open (DO) and calving interval (CI) are the bases for a profitable dairy farming (Mukasa-Mugerewa, 1989).

Age at First Service
According to Gidey (2001), age at first service (AFS) is the age at which heifers attain body condition and sexual maturity for accepting service for the first time. By showing estrous as early as possible, a female animal can contribute more to the economy of the farm. Age at first service of some zebu and crossbred dairy cattle in some part of Ethiopia is presented in Table 1.
Table 1 Average age at first service of different zebu and crossbred cattle

<table>
<thead>
<tr>
<th>Breed</th>
<th>Age at first service (months)</th>
<th>Sources</th>
</tr>
</thead>
<tbody>
<tr>
<td>Horro</td>
<td>47.52 (male) and 53.3 (female)</td>
<td>Jiregna (2007)</td>
</tr>
<tr>
<td>Horro</td>
<td>46.56 (male) and 48.42 (female)</td>
<td>Ayantu et al. (2012)</td>
</tr>
<tr>
<td>Semen and Wegera</td>
<td>55.6 (male) and 57 (female)</td>
<td>Zewdu (2004)</td>
</tr>
<tr>
<td>HorroX Jersey</td>
<td>33.3±10.9</td>
<td>Demissu et al. (2014)</td>
</tr>
<tr>
<td>Frisian X Fogera</td>
<td>36.8±0.8</td>
<td>Gebeylehu et al. (2005)</td>
</tr>
</tbody>
</table>

Age at First Calving

Age at first calving determines the beginning of the cow’s productive life and influences her lifetime productivity (Ojango and Pollott, 2001). A recent study reported that dietary supplementation of heifers during their period of growth reduces the interval from birth to age at first service and birth to age at first calving (Amin et al., 2013). Age at first calving of zebu breeds and crossbred cattle of some parts of Ethiopia is presented in Table 2.

Table 2 Age at first calving of different zebu and crossbred cattle

<table>
<thead>
<tr>
<th>Breed</th>
<th>Age at first calving (months ±SE)</th>
<th>Sources</th>
</tr>
</thead>
<tbody>
<tr>
<td>Horro</td>
<td>58.08±0.07</td>
<td>Ayantu et al. (2012)</td>
</tr>
<tr>
<td>Fogera</td>
<td>50.8±0.36</td>
<td>Menal et al. (2011)</td>
</tr>
<tr>
<td>Local/Dandi</td>
<td>50.59±6.94</td>
<td>Belay et al. (2012)</td>
</tr>
<tr>
<td>Horro X Jersey</td>
<td>42.2±11.45</td>
<td>Demissu et al. (2014)</td>
</tr>
<tr>
<td>Fresian X Zebu</td>
<td>36</td>
<td>Belay et al. (2012)</td>
</tr>
</tbody>
</table>

Longevity and Reproductive Lifespan

Herd life of cows affects the profitability of dairy farms. According to (Mukasa-Mugerwa et al. 1989) reported that herd life productivity of Ethiopian indigenous cattle was 11 to 13 years. (Gidey, 2001) also reported that lifetime productivity of fogera cattle was 9.6 years. The mean for herd life and effective productive herd life of fresian-Boran crossbred in Chefa farm of Ethiopia was 7.9 years (Gosh, 2005). Kumar and Reddy (1989) reported that the reproductive life time of the breeding bull and female was 9.86 and 11.5 years in the lowland, and 7.68 and 10.9 years in mid-highland areas, respectively and the female was giving calves on average 7.1 in lowland and 6.6 in midland area. The lifetime productivity of a cow is influenced by age at puberty, age at first calving and calving interval (Ensminger, 1969), genetic makeup and the health status of the cow (Goshu, 2005) and management and feeding standards (Abdulai and Huffman, 2005).

Summary and Conclusion

Cattle comprise the majority of the livestock population in Ethiopia and are reared across all the agro-ecologies. However, productivity of cattle is limited by several constraints that include natural uncontrolled and unorganized breeding practice, high prevalence of diseases, poor reproductive performance, limited feed availability and poor marketing system and lack of recording system. To address these constraints indigenous knowledge of farmers and designing appropriate mating systems with full participation of farmers is the best option in improving breeding practice of dairy cattle in Ethiopia.

Breeding strategies need to involve farmers, considering the existing breeding practices, management systems and their trait preferences. Selection of livestock production system is key factor for obtaining animals for breeding and has a strong influence on reproductive performance of the herd. Exploring indigenous knowledge of managing the herd, setting of breeding objectives and finally designing appropriate mating systems with full participation of farmers is of paramount importance in improving dairy cattle. In conclusion, farmers should be train on various aspects of improving breeding practice of dairy cattle in Ethiopia.

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