

Research Article

Breed Preferences and Breeding Practices of Dairy Cattle in Arsi Negele Town, West Arsi Zone, Oromia, Ethiopia

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Abstract

This study investigated farmers' breeding practices, trait preferences, and dairy cattle performance in Arsi Negele town, West Arsi Zone, Oromia, Ethiopia. *Although Ethiopia's cattle genetic diversity is extensive and indigenous breeds are highly adaptable, productivity remains low due to limited genetic improvement and husbandry challenges.* A cross-sectional survey involving 150 households from three urban kebele, data on herd structure, breeding systems, socio-economic status, and farmer preferences were collected through questionnaires, participatory appraisals, and direct observations. Results indicate that farmers predominantly prefer high-grade dairy cattle for improved milk yield and reproductive performance, in line with national breeding goals emphasizing high levels of exotic breed genetics. Artificial insemination (AI) and natural mating with improved bulls are practiced. However, AI service delivery faces constraints such as shortages of semen and limited farmer awareness. Cattle constitute the main livestock holding and a primary income source through milk and meat sales. Households display slightly larger family sizes than national averages, with gender-differentiated labor, notably female participation in milking and milk processing. Health management suffers from insufficient veterinary resources despite farmers' good disease awareness, pushing many to rely on private providers. The study underscores local knowledge and willingness to improve productivity, but structural limitations in AI services, animal health, and feed resources hinder progress. Recommendations include improving semen supply chains, enhancing AI technician training, increasing farmer education on breeding, strengthening veterinary services, promoting feed conservation, and supporting gender-inclusive capacity building. Establishing community-based breeding programs and longitudinal studies are advocated to monitor genetic gains and socio-economic impacts, guiding sustainable interventions for dairy development in the area.

Keywords

Breed, Composition, Preference

1. Introduction

1.1. Background

Ethiopia is endowed with a rich diversity of indigenous cattle genetic resources and hosts a variety of livestock production systems. This diversity is largely driven by sig-

nificant agro-ecological variation, cultural and ethnic diversity, and a long history of agricultural practice. The country recognizes 32 indigenous cattle breeds and possesses a vast amount of undocumented indigenous knowledge related to cattle genetic resource management [1,

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2]. Approximately 99.4% of the total cattle population in Ethiopia consists of indigenous breeds, while hybrids and exotic breeds contribute about 0.5% and 0.1%, respectively. These cattle are predominantly managed by smallholder farmers and pastoralists [1, 3, 4].

Across Ethiopia's diverse agro-ecologies, cattle fulfill multiple functions including providing milk, meat, income, and fulfilling social roles. Despite this multi-functionality, productivity remains low due to the absence of systematic genetic improvement interventions, low input levels, traditional husbandry practices, and high environmental stress [5, 6]. Nonetheless, indigenous breeds possess valuable adaptive traits that enable subsistence-level production under challenging conditions. The national average lactation period of indigenous cows is about eight months, with an average daily milk yield of approximately 1.284 liters per cow. Lactation yields under optimal management range from 494 to 850 kg. Indigenous cows typically exhibit late age at first calving (35-53 months) and prolonged calving intervals of about two years [7, 8]. The combination of low genetic potential, feed shortages, disease prevalence, limited management, and inadequate breeding practices such as poor heat detection and delayed insemination contributes to extended days open, delayed maturity, and overall reduced productive and reproductive performance [9].

1.2. Statement of the Problem

In Ethiopia's dairy cattle breeding systems, natural mating using indigenous bulls remains the predominant method, especially across highland, midland, and lowland areas. Some artificial insemination (AI) adoption occurs primarily in highland and midland regions [10]. Livestock keepers' trait preferences vary widely across different communities, agro-ecologies, and production systems [11, 12], resulting in diverse priorities and trait rankings depending on local production contexts. To design effective interventions aimed at enhancing the productivity of the dairy subsector, it is essential to understand local farmers' breeding practices and their trait preferences related to indigenous dairy cattle. Creating a site-specific database that reflects the production environment and local farming scenarios is crucial. Despite its importance, limited research has been conducted to identify the breeding practices and trait preferences of farmers in Arsi Negele town, West Arsi Zone. This knowledge gap limits the formulation of appropriate breeding strategies and improvement programs tailored to the area. Therefore, this study seeks to fill this gap by investigating prevailing breeding practices and trait preferences, while proposing solutions to address constraints inherent to the local production environment.

1.3. Objective

1.3.1. General Objective

The general objective of the study was to investigate

farmers' breeding practices and trait preferences related to dairy cattle production in Arsi-Negele town, West Arsi Zone, Oromia, Ethiopia.

1.3.2. Specific Objectives

- 1) To identify farmers' preferences for dairy cattle breeds and key production and reproductive traits under local production conditions.
- 2) To assess the prevailing breeding systems and mating practices utilized by farmers.
- 3) To evaluate the performance and herd structure of dairy cattle managed by farmers.
- 4) To suggest appropriate interventions and possible solutions to enhance dairy cattle productivity and breeding practices.

2. Materials and Methods

2.1. Description of the Study Area

Arsi Negele Town, located in the West Arsi Zone of Oromia Regional State, Ethiopia, is situated in a semi-arid to sub-humid agro-ecological zone with bimodal rainfall distribution characterized by a short rainy season and a longer main rainy season. The town sits at an altitude ranging from approximately 1500 to 2000 meters above sea level, supporting mixed crop-livestock farming systems. It features both urban and peri-urban dairy production systems, predominantly managed by smallholder farmers. The town's elevation is reported to be around 1899 to 2043 meters according to various sources, which aligns with its agro-ecological characteristics favoring dairy farming and mixed agriculture. The local climate and elevation contribute to the viability of livestock and crop production in the area, with dairy cattle playing a significant role in household livelihoods and the local economy.

2.2. Research Design

A cross-sectional field study design was employed to collect both qualitative and quantitative data. The study aimed to investigate farmers' breeding practices and trait preferences related to dairy cattle production.

2.3. Sample Size and Sampling Techniques

A total of 127 households were selected from three urban kebeles in Arsi Negele town. Among these, 45 households were dairy farms, and 82 were mixed farms (dairy and beef). The selection of households was purposive random, based on cattle population data obtained from local agricultural offices to ensure representative coverage of the main production systems in the area.

Farmers invited to participate in focus group discussions

were purposively selected for their knowledge and experience regarding local cattle resources. Development agents assisted in identifying these knowledgeable participants.

This sampling approach aimed to capture diverse breeding practices, breed preferences, and management conditions within the urban kebeles of Arsi Negele.

2.4. Data Collection

Primary data were collected through semi-structured questionnaires and face-to-face interviews with dairy and mixed farms to gather information on household size and age structure, educational status, household income, purpose of keeping animals, labor division, livestock holding, breed composition, breeding system, breed preference, breeding system, source and preference of semen and animal health. Focus Group Discussions with groups of farmers were used to explore local perceptions, problems, and indigenous knowledge. Key Informant Interviews with livestock extension workers, veterinary officers, and dairy cooperatives representative provided expert insights. Secondary Data were collected through review of relevant reports, government documents, and previous research studies on milk production in the West Arsi Zone and similar agro-ecologies.

2.5. Data Analysis

Quantitative data collected through questionnaires were carefully checked for completeness and errors, systematically coded, and entered into SPSS [13] for analysis. Descriptive statistics, including means, frequencies, and percentages, were calculated to summarize variables such as household demographics, herd structure, breed preferences, breeding practices, income sources, and other management characteristics. Inferential tests such as t-tests and chi-square tests were conducted to assess differences in household income across farm types and to examine associations among categorical variables where appropriate. All statistical analyses were performed at the 0.05 level.

3. Result and Discussion

3.1. Household Size and Age Structure

Both males and females were interviewed in the course of the study. Seventy percent of the respondents were male, while the remaining thirty percent were female. The overall average age of respondents was 46.79 years. Depend on farm types; the mean ages were 50.89 years for dairy farms, 41.43 years for beef farms, and 46.04 years for mixed farms. Among respondents engaged in dairy, beef, and mixed farms, ages ranged between 21 and 70 years, with specific ranges of 26–68 years for dairy, 27–65 years for beef, and 21–70 years for mixed farms. The age distribution of respondents was 31.58% under 16 years, 64.38% between 16 and 60 years, and 4.04%

above 60 years. These results indicate that the majority of respondents involved in cattle production are under 60 years old, highlighting that this sector heavily depends on a working-age population. Eighty-five percent of the respondents were owners of the farm, 10% were members of the farm, 4% were relatives of the family, and 1% was a hired laborer considered as family member. The overall mean family size was 7.11 ± 0.19 persons per family ranging from 1-14 persons. This value was higher than the national average of 5.2 persons [14] and the average family size of 5.1 persons per household in Arsi zone [15], but comparable to the average family size of 7.6 persons reported in Hawassa [16]. Average family sizes are 7.4 persons for dairy farms, 6.3 for beef farms, and 7.2 for mixed farms. The relatively larger family size in dairy farms may be due to the inclusion of female hired laborers for areke (a local traditional drink production) distillation, who are considered as family members by respondents. Households with dairy farms tend to be economically better off, using hired labor and allowing family members to attend school. The overall gender ratio in household members is about 46% male and 54% female. Among farm owners, 80.7% are male and 19.3% are female. The proportion of female-headed households (around 19.3%) is slightly lower than that reported for other regions such as Addis Ababa milk shed (24.1%) [17] and Hawassa (23.3%) [16].

3.2. Educational Status

The educational level of the interviewed household farmers revealed that 82.7% were literate, 1% hadn't gone through formal education but could read and write, whereas 7.3% were illiterate (not read and write). A comparable literacy rate of 78% among farm owners was reported for Addis Ababa milk shed [17]. Among the literacy members, 35.33%, 15.33%, 14.67%, 11.33%, and 6% had gone through junior (5-8), primary (1-4), preparatory (11-12), secondary (9-10), and above secondary school, respectively. Such higher literacy rate in urban areas was due to better basic educational infrastructure in towns. Considering farm types, the level of illiteracy tended to be high for beef farm (8.70%) and mixed farm (7.32%) compared to dairy (6.67%) farms. This indicates that members in dairy farms had better access to education. Problems related to poor record-keeping are minimal, which indicates that more attention is given to milking cows. Consequently, owners of dairy farms tend to have better knowledge of production activities.

3.3. Household Income

Cattle provide cash income mainly through the sale of milk and meat, which aligns with your mention of households selling milk to generate cash. Milk and dairy products tend to be the dominant source of income for many households, contributing a significant portion of total farm income, similar to the 39.86% you cite.

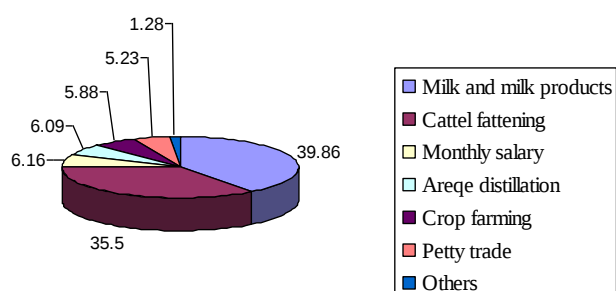


Figure 1. Sources of household income.

The overall average gross income gained per households was 2523.14±133.02 Ethiopian birr (ETB) per months. Analysis of variance shows that farming type has highly significant effect ($P<0.01$) on household income. In mixed farms higher income than in dairy or beef farms, consistent with in mixed farms earn more (3077.73 ETB/month) compared to dairy (1828.44 ETB) and beef farms (1809.71 ETB). This reflects diversification benefits where in mixed farms combine dairy and fattening activities, often enhancing resilience and income. Milk and milk products are the dominant source of income for household and contribute 39.86% to the total income of farms. Cattle fattening contribute the second dominate source of income and contribute 35.50% to the total income of the farms. The contribution of monthly salary, areke making, crop sales, petty trading, and other sources for household income were 6.2%, 6.1%, 5.9%, 5.2% and 1.3%, respectively. This reflects diversification benefits where mixed farms combine crop and livestock activities, often enhancing resilience and income, respectively [18] and [19] also reported that sale of milk and milk products contributed to 46% of the household income in the southern Ethiopia. The proportion of income from cattle production (75.4%) compared with other sources of income indicates that the majority of household depend their livelihood on milk and meat production.

3.4. Purpose of Keeping Animals

Most of dairy, beef and mixed farm owners have other sources of income. The dairy cows in dairy and mixed farms were kept for income from sale of milk, milk for consumption and income from sale of culled animals. Oxen were kept for fattening and draft purposes. In 52% of farms, dairy cows contribute primarily to income sources and milk for consumption. Moreover, 33.1% of farmers rely on their dairy cattle as a source of income, while 12.6% keep cows mainly for home consumption. Only 2.4% of dairy farms rely on selling milk and culled animals as a source of income. Based on farm types, no consistent pattern was observed regarding the contribution of dairy to family income. 62.2% of dairy and 46.3% of mixed farms indicated that dairy contributes both as a source of income and milk for home consumption; 29% of dairy farms and 35.4% of mixed farms dairy as a source of

cash income only; and 6.7% of dairy and 15.9% of mixed farms dairy as a source of income while using the milk for home consumption. Oxen in dairy (2.4%), beef (21.7%), and mixed (41.5%) farms were kept for draft purposes. For most farms, horses and donkeys are kept as an additional source of income by transporting people, materials, and manure. Small ruminants are used as a source of cash income.

3.5. Labor Division

Most of the work in dairy farms (77.8%) was done by family members to minimize labor expenses. However, in most beef (31%) and mixed (60%) farms, a greater proportion of work was carried out by hired labor. As indicated by household income, the owners of mixed farms were relatively better off economically, and they tended to educate their family members and use hired labor for farm activities. About 44% of the households engaged in livestock activities were involved in business (including areke making and marketing and different forms of petty trades); 27.3% were farmers who didn't have any activities other than farming; and 14.7% were government employees (civil servants). The rest were daily laborers (2%), pensioners (5.3%), farmers with business activities (4%), pensioners with farming activities (2%), and pensioners with business activities and others like brokers (0.7%).

A clear division of labor with regard to dairying and fattening was observed among household members. Most farming activities, including purchasing and selling cattle, breeding, milking, milk processing, selling dairy products, cleaning the barn, waste disposal, feeding animals, as well as caring for sick animals, were the responsibility of adult family members in 89% of the total interviewed farms. Adult male family members were mainly involved in purchasing and selling cattle (76.3%), breeding (72.9%), caring for sick animals (64.7%), feeding (48%), waste disposal (47.3%), cleaning the barn (45.3%), selling dairy products (31.4%), milking (31.4%), and milk processing (15%). The highest participation of adult female family members was observed in milk processing (73.8%), milking (62.8%), selling dairy products (52%), cleaning the barn (40.4%), waste disposal (38.9%), feeding (36.3%), caring for sick animals (29.4%), breeding (20.6%), and purchasing and selling cattle (19.5%). Boys were mainly involved in feeding (6.6%), selling dairy products (6%), waste disposal (5.9%), and cleaning the barn (5.7%) in all farms, and had less involvement in cattle purchasing and selling, breeding, and caring for sick animals. Girls were mainly involved in selling dairy products (9.9%), waste disposal (9.3%), dairy processing (9.3%), cleaning the barn (9%), and feeding (7.4%) in all farms, and had less involvement in cattle purchasing and selling, breeding, milking, and caring for sick animals. No hired girls were involved in any dairy activities.

3.6. Livestock Holding

The average livestock holding per household was 9.49 ± 0.56 heads, with dairy farms owning 8.95 ± 0.75 heads and

mixed farms owning 10.16 ± 0.59 heads.

Table 1. Livestock holding and composition per household.

	Dairy farm	Beef farm	Mixed farm	Overall
Variable	Mean $\pm$ SE	Mean $\pm$ SE	Mean $\pm$ SE	Mean $\pm$ SE
	N=45	N=23	N=82	N=150
Livestock	8.95 ± 0.75	8.30 ± 2.61	10.16 ± 0.59	9.49 ± 0.56
Cattle	7.13 ± 0.57	6.96 ± 2.57	8.11 ± 0.48	7.63 ± 0.50
Sheep	1.27 ± 0.31	1.13 ± 0.50	1.30 ± 0.22	1.27 ± 0.17
Goats	0.04 ± 0.04	0.04 ± 0.04	0.06 ± 0.05	0.05 ± 0.03
Donkey	0.38 ± 0.08	-	0.32 ± 0.07	0.29 ± 0.05
Horses	0.13 ± 0.08	0.17 ± 0.58	0.33 ± 0.10	0.25 ± 0.06

Cattle represented the most significant proportion, accounting for 80.4% of the total livestock, a figure notably higher than the 63% reported in the Debre-Berhan area [20]. On average, each farmer owned 7.1 cattle in dairy farms and 8.1 cattle in mixed farms. These cattle holdings are similar to those of smallholders in Holeta, Selale, and Debre-Zeit [18], as well as to the 7.6 cattle per household reported in southern Ethiopia [19]. These figures closely align with the present study's average of 7.63 cattle per household.

3.7. Cattle Herd and Breed Composition

A total of 1,137 cattle were recorded among the interviewed households. Of the total herd, cows constituted 37.4%, including local (13.7%), crossbred (6.1%), and high-grade (cattle with at least 62.5% exotic dairy breed genetics) (17.6%) cows. The average number of cattle per household in this study exceeded the 6.85 heads reported in Hawassa [16]. The proportion of cows (37.4%) was similar to that in Hawassa (37.2%), but lower than the national average of 42% and the 50% reported in urban and peri-urban areas of the Addis Ababa milk shed [17]. Ownership distribution indicated that 321 heads (28.2%) belonged to dairy farms, while 656 heads (57.7%) were owned by mixed farms. The larger livestock holdings in mixed farms are partly due to the higher number of sampled farms. However, dairy farms maintained a greater number of graded cattle and had better management options for these breeds, likely because of strong demand and reliable markets for milk from high-grade animals.

Despite a preference among smallholders for crossbred cows due to their superior milk yield and reproductive traits,

farmers in the study area kept fewer crossbreds relative to local breeds. This pattern is consistent with the findings around Debre-Zeit, where only one crossbred cow was reported among 30 interviewed farmers [18].

Sixty-four percent of farmers preferred high-grade dairy animals over local and crossbred types, corresponding with national recommendations favoring at least 62.5% exotic dairy bloodlines. Breed choice was primarily driven by production traits, with 47.2% of households selecting breeds for higher milk yield. Other important criteria included fertility (35.4%), availability of breed (6.3%), milk yield combined with availability of breed (5.5%), and milk yield combined with fertility (7.7%). Replacement stock was primarily sourced from heifers (11.9%) and female calves (6.8%), while male calves accounted for 9.9% of the herd. The higher proportion of male calves reflects typical herd demographic trends. However, as bull calves are often uneconomical to maintain, they are typically sold cheaply or culled early. Breeding bulls represented 14.7% of the total herd, with exotic breed bulls mainly concentrated in dairy farms.

3.8. Breed Preference

All respondents were aware of the advantages gained from proper breeding practices. An attempt was made to assess the genetic resources and factors influencing breed choice. Results of the study indicated that 60%, 35.6%, and 4.4% of dairy farms preferred to have high-grade, crossbred, and local cows, respectively. Similarly, 54.9%, 36.6%, and 6.1% of mixed farms preferred to have high-grade, crossbred, and local cows, respectively, and 2.4% preferred to have both

high-grade and crossbred cows. Those who preferred local cows in both dairy and mixed farms indicated their choice was due to lack of manpower, feed shortage, and limited management capacity. For 44.4%, 44.4%, and 6.7% of respondents in dairy farms, breed choice was determined by milk yield potential, milk yield combined with reproductive efficiency, and milk yield combined with availability of breeds, respectively. Similarly, for 50%, 31.7%, and 4.9% of respondents in mixed farms, breed choice was determined by milk yield potential, milk yield combined with reproductive

efficiency, and milk yield combined with availability of breeds, respectively. For the remaining few farmers in both farm types, breed choice was influenced by factors such as milk yield combined with milk quality, disease resistance, reproductive efficiency, cost of the breed, and/or feed consumption. According to respondents, about 60% of dairy farms and 55% of mixed farms used high grade sires for their milk yield. About 36% of dairy farms and 37% of mixed farms used crossbreds, while the rest used local sires in combination with crossbred sires.

Table 2. Breed and factors influencing the choice of breed.

Factors	Parameter	Farm type					
		Dairy		Mixed		Total	
		N	%	N	%	N	%
Breed	High-grade	27	60	45	54.88	72	56.69
	Crossbreed	16	35.56	30	36.59	46	36.22
	Local zebu	2	4.44	5	6.10	7	5.51
	Both	-	-	2	2.43	2	1.58
	Total	45	100	29	100	35	100
Choice of breed	Milk yield	20	44.44	41	50	61	48.03
	Availability	2	4.44	5	6.10	7	5.51
	Reproductive efficiency	-	-	1	1.22	1	0.79
	Milk quality	-	-	1	1.22	1	0.79
	Milk yield and availability	3	6.68	4	4.88	7	5.51
	Milk yield and reproductive efficiency	20	44.44	26	31.70	46	36.22
	Milk yield, availability and reproductive efficiency	-	-	4	4.88	4	3.15

3.9. Breeding System

Artificial insemination (AI), natural mating (using improved and local bulls), and combinations of these methods (AI and Bulls) are used for breeding cows. About 71.1% of dairy farms and 65.9% of mixed farms depended on both AI and natural service with improved breeds. About 13.3% of dairy farms and 13.4% of mixed farms relied solely on AI. About 15.6% of dairy farms and 19.5% of mixed farms depended on natural service with improved breeds. No dairy farms depended on natural service with local breeds, though only one farm (1.2%) among mixed farms depended on natural service with local breeds. In Hawassa, 68.3% of farms preferred to use AI, although only about 50% of farmers were actually using AI [16].

Depending on the farm types, the choice of mating type is mostly determined by milk yield potential and the availability of bulls or semen in both dairy and mixed farms. For about 71.1% of dairy farms and 52.4% of mixed farms, the choice of mating type is mostly determined by a combination of milk yield potential and availability of bulls or semen. For about 9% of dairy farms and 21% of mixed farms, the choice is based solely on availability of bulls or semen. For about 15.6% of dairy farms and 9.8% of mixed farms, choice of mating type is determined by milk yield potential. Two-thirds of the total respondents use AI service in combination with natural mating using improved bulls. Due to an insufficient supply of semen, they are forced to keep bulls for natural service. Bull service management is also expensive; the service fee for an exotic breed bull ranges from 20 to 30 ETB per service, while service with a local breed bull

is free of charge.

3.10. Source and Preference of Semen

Artificial insemination (AI) services in the study area rely on semen from bulls selected and supplied by governmental organizations, used by all dairy and mixed farms. All dairy and mixed farms use semen from bulls selected and supplied by governmental organizations. The majority of dairy farmers (92%) and all mixed farmers are unaware of the exact source of the semen used on their farms. Regarding semen preference, farmers generally accept the semen supplied from the Agricultural and Rural Development Office, which derives its semen from Holstein bulls selected at the Artificial Insemination Center. However, many dairy and mixed farms prefer imported semen and/or semen from imported bulls, reflecting a desire for genetically superior stock to improve production.

4. Conclusion

This study investigated breed preferences, breeding practices, and the performance of dairy cattle in Arsi Negele town, highlighting the production environment and socio-economic characteristics of farming households. The findings indicate a clear farmer preference for high-grade dairy cattle, primarily motivated by milk yield potential and reproductive efficiency, consistent with national breeding policies targeting a high exotic blood level. Although crossbred cattle are valued for their improved milk production and fertility traits, local breeds remain important for some farmers due to their adaptability, lower input requirements, and suitability under existing management conditions.

Breeding systems in the area predominantly combine artificial insemination (AI) and natural mating with improved bulls. Dependence on government-supplied semen is high, although many farmers lack detailed knowledge about semen sources. Shortages in AI service delivery and semen availability compel farmers to keep bulls for natural mating, which increases management costs. Health management practices show that farmers have good awareness of common diseases; however, veterinary service delivery faces challenges such as shortages of drugs and equipment. As a result, farmers often rely on private providers for animal health care. Household demographics reveal slightly larger family sizes compared to national averages, with a division of labor heavily reliant on family members especially females for milking and milk processing. Livestock holdings are dominated by cattle, providing the main source of household income through milk and meat sales. Income analysis confirms the economic significance of dairy and mixed farming systems in the study area. Overall, the study underscores that while farmers demonstrate willingness and local knowledge to improve dairy cattle productivity through breed choice and breeding practices, structural constraints in AI service provision, animal health services, feed resources, and management continue

to limit their potential.

5. Recommendation

Recommendations to enhance dairy cattle breeding and Production in Arsi Negele Town;

- a. Enhance the supply chain and accessibility of quality semen by integrating both imported semen and locally selected elite bulls.
- b. Provide comprehensive training and capacity building programs for AI technicians to ensure timely, effective, and high-quality insemination services.
- c. Increase farmer awareness and education on breed types, the benefits of artificial insemination (AI), and breed-specific advantages to encourage wider adoption.
- d. Establish community-based breeding programs that incorporate farmers' preferences, focusing on traits such as milk yield, fertility, and adaptability to local management conditions.
- e. Encourage farmers to maintain records and monitor performance traits (e.g., milk production, reproductive success) to inform better breed selection decisions.
- f. Introduce and promote improved feed conservation techniques (e.g., haymaking, silage) and encourage the use of feed supplements, especially during dry seasons to mitigate nutritional stress.
- g. Provide ongoing extension services, training, and technical support to farmers on optimal feeding strategies and forage production to enhance animal nutrition and productivity.
- h. Offer gender-inclusive training programs covering dairying best practices, including heat detection, breeding management, calf rearing, and animal health care, ensuring women's active participation.
- i. Facilitate knowledge-sharing forums and farmer groups to strengthen participation in breeding and herd management decisions, promoting peer learning and community empowerment.
- j. Conduct longitudinal studies to track genetic progress, reproductive performance, health outcomes, and productivity of different breeds under local environmental and management conditions.
- k. Evaluate the socio-economic impacts of breed choices and management approaches on farm incomes and livelihoods to inform evidence-based policy and program development.
- l. Use research findings to adapt and refine breeding strategies and extension services tailored to local contexts.

Abbreviations

AI	Artificial Insemination
ETB	Ethiopian Birr
SPSS	Statistical Package for the Social Sciences

Author Contributions

Mulugeta Tesfaye is the sole author. The author read and approved the final manuscript.

Conflicts of Interest

The author declares no conflicts of interest.

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