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Performance Evaluation of Arsi, Kereyu and Their Crossbred Cattle Under Current Climate Change in Mid Rift Valley of Oromia, Ethiopia

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Abstract: The study was conducted in Fentale and Boset districts, East Shoa Zone, Oromia Region, Ethiopia. The objective of this study was to identify morph metric variation between cattle breeds of Arsi, Kereyu and their crossbred, and to evaluate adaptive, productive (milk yield) and reproductive performance of these cattle breeds, and their crossbred in the mid rift valley of Oromia Region. Three PA's from each district, a total of Six PA (Huluka, Kawa, Barchota, Benti, Kobo and Dakaedu) were selected purposively. Respondents' were identified using purposive sampling technique. Kereyu, Arsi and crossbred cattle of the two were reared for, milk production, risk aversion and source of income. The major production constraints identified were feed shortage, water scarcity, disease and coverage of grazing land by invasive plants. Arsi cattle's have long age at first mating (3.87±.17), age at first calving (4.66±0.2) and calving interval (1.50±0.125) than Kereyu (3.78±0.23, 4.52±0.25, 1.39±0.19) and crossbred (3.86±0.11, 4.64±0.12, 1.49±0.14) in both study location while the crossbred cattle have medium Values respectively. Arsi cattle have short Lactation length than kereyu and Crossbred (6.36, 7.51, 7.11months for Arsi, kereyu and crossbred respectively also similar for daily milk yield (1.26, 1.71 and 1.43). The farmers in the two district prefer Kereyu breed due to their ability to tolerate drought, disease and highly adaptable to the area where as Arsi breed of cattle was susceptible to feed shortage, water scarcity and disease than other breed in the area. This study revealed that the Arsi community in the study area prefers to mate breeding female of Arsi with bull of Kereyu breed.

Keywords: Arsi Cattle, Kereyu Cattle, Performance Evaluation

1. Introduction

Ethiopia has long been recognized as the center of origin of diverse livestock genetic resources both in Africa and the world at large. The existence of broad diversity is due in large part to its geographic location, diverse topography, climate, the wide range of production systems and the huge livestock population size [8]. The total cattle population for the country is estimated to be about 60.39 million [8].

Ethiopian cattle genetic diversity is currently under threat mainly due to extensive planned as well as indiscriminate cross breeding between exotic and indigenous and crossing between indigenous breeds, and interbreeding among the local populations. In this regards, the study by Zewdu Edea [33] show that Danakil cattle demonstrated the lowest genetic variability (0.370) than other indigenous cattle breeds in Ethiopia and the relatively lower genetic diversity observed in the Danakil cattle population could be due to inbreeding (FIS=0.012) and uncontrolled mating practices that are common among the pastoral herds. As the author noted the high within-population genetic diversity and the unique adaptation of the current populations to wider environmental factors might be a consequence of the peculiar admixture between the different cattle breeds. This interbreeding undertaken among various cattle breeds by different communities may be to withstand the impact of the current climate change on their breed. In this regard, earlier studies [22] noted that indiscriminate interbreeding or crossbreeding and civil conflicts are the major causes of breeds or strains being classified as at risk in Africa for cattle and for other species. But until now these populations have represented a unique genetic resource and unexploited opportunity that warrants initiatives for their sustainable conservation and

utilization. Similarly the study by Kassa-Mersha H. and Arnason [13] noted that the Ethiopian cattle are under threat from uncontrolled mating practices and inbreeding among different indigenous cattle breeds and are at high risk of becoming genetically homogeneous. Earlier study of Rege JEO [21] suggested that increasing human migration, trade, cultural and social interactions exacerbate interbreeding between adjacent indigenous breeds.

Genetic diversity is the basis for present day diversified living systems and adaptability and it is a tool for future genetic improvement of livestock breeds. This diversity should be properly utilized, improved and conserved. Conservation and improvement strategies ought to be based on proper genetic characterization in association with phenotypic characterization. The study by Zewdu Edea [33] indicated that the relationships among Ethiopian cattle populations reflect their history of origin and admixture rather than phenotype based distinctions. The high within individual genetic variability observed in Ethiopian cattle represents an untapped opportunity for adaptation to changing environments and for implementation of within-breed genetic improvement schemes.

Climate change likely affects the productive and reproductive performances of cattle, and consequently their population growth through its indirect effects on the quantity and quality of pastures, availability of water, and posing thermal stresses on animals [30].

In this regard, the study by [32] revealed that some of the pastoralists in Afar region, lost interest on their indigenous cattle and start crossing with Kereyu cattle breed. The pastoralists presume that Kereyu cattle breed is more tolerant than Afar breed to the present drought and climate change. This kind of crossing due to climate change is common among different indigenous cattle breeds of Ethiopia including Kereyu and Arsi cattle breeds. As a consequence of uncontrolled crossing between indigenous breeds, the pure line indigenous breeds may be threatened for extinction with their valuable traits.

However, comparative evaluation of performance and adaptable character of pure and their cross breed cattle was scanty in Ethiopia. Hence with the above background this study was conducted to understand if there is variation among the breeds in terms of performance with the following objectives.

1.1. General Objective

To examine variation between indigenous cattle breeds of Arsi, Kereyu and their crosses and evaluate adaptive, productive (milk yield) and reproductive performance of the breeds in the mid rift valley of Oromia Region.

1.2. Specific Objectives

To identify the productive, reproductive performance, and adaptive characters of the indigenous breed and their crosses in the study area.

2. Literature Review

2.1. Origin of Ethiopian Cattle

A number of theories have been developed as to the time and the routes by which cattle were introduced into Ethiopia. They could have been introduced from the Nile valley, the Red Sea littoral, across the Red Sea from Arabia, or by all these routes at different times [20]. The review on origin, domestication, and breed development in northeast Africa reveals that Ethiopia has become the region in which longhorn, shorthorn, and zebu types cattle have been crossed and interbred. The interbreeding has produced the Sanga type breeds, whilst continuous upgrading of hump less longhorn and shorthorn cattle with new Zebu blood has produced new zebu type breeds [19, 20]. In addition, some reports indicated that, recently, four other cattle types are identified in the country, which are the Babbawa, Jiddu, Red Bororo and Tigray. But the newly identified cattle types are not well studied clearly as to which group they belong to [31].

2.2. Ecology of Natural Habitat of the Kereyu Breeds

The home tract of the Kereyu cattle type is Fentalle district. Their breeding environment is characterized by low input-output, high environmental stress and no infrastructure for livestock development programs. The current estimated total cattle population in Fentalle district is 125 thousand. Maya cattle (Kereyu x Arsi) are common in the district and the proportion of pure Kereyu breed of cattle was not determined in this study. However, a gradually decreasing trend of pure Kereyu breed was reported. Recurrent drought, rangeland degradation, population pressure, feed and water shortage, interbreeding with the surrounding local zebu cattle and lack of conservation program were among the identified threats to the Kereyu cattle type [25].

2.3. Performance of Cattle Breeds in Ethiopia

The CSA [8] estimates 3.06 billion liters of cow milk produced annually from indigenous breeds and average milk yield per cow per day and the average lactation period per cow were 1.37 liters and 6 months, respectively. Cattle produce a total of 0.331 million tons of meat annually [9] although Ethiopia possesses high cattle genetic resources, their productivity is considerably low.

Ethiopia has diverse animal genetic resources and its relatively large livestock population (approximately 100 million) is well adapted to and distributed among diverse ecological conditions and management systems [15]. In Ethiopia as many developing countries, livestock play multiple roles. Despite the huge number of cattle and their economic importance, the productivity is low due to the constraints of disease, nutrition, poor management and poor genetic performance of indigenous breeds. These constraints result in poor reproductive performance of dairy cattle. Among the major problems that have direct impact on reproductive

performance of dairy cows are abortions, dystocia, Retained Fetal Membrane (RFM), metritis, prolaps (uterine and vaginal), anoestrus and repeat breeder. These could be classified as prepurtum and postpurtum reproductive problems [23, 15].

Fogera cattle is low, ranging from 494 to 809 kg per lactation [11].

Information on productive and reproductive performance traits of traditionally managed cattle including the intended breed that going to be studied in their home tract in the country is scanty.

2.4. Breed Preferences of the Livestock Holders

Majority of the Kereyu people preferred to continue rearing Kereyu cattle and one-third of the respondents wanted to keep other breed in addition to Kereyu cattle. Most reported preference was for Borana breed and next Arsi breed for the purpose of milk production. Their preference for sex was higher for breeding females than breeding males. This high reported preference for breeding females was associated with the social and cultural value that they attach to their own breeding males in maintaining the desired quality of their animals in that particular environment [24].

2.5. Effect of Climate Change and Coping Mechanism of Pastoralist on Husbandry and Breeding Practices

Mobility is an inherent strategy of pastoralists to optimize production under a heterogeneous landscape and a precarious climate. The search for water (for human and livestock consumption) and forage, trigger mobility and migration; these strategies were most intensified by drought. Distance trekked to livestock water sources is almost tripled during the drought, from an average (across zones) of 5.9 km pre-drought to 15.8 km during the drought; pure pastoralists trek greater distances than agro pastoralists. Distances to grazing sites also increase, from an average (across zones) of 5.5 km pre-drought to 20.4 km during the drought, with pure pastoralists trekking greater distances than agro pastoralists.

3. Materials and Methods

3.1. Description of the Study Area

The study was conducted in Oromia regional state, east Showa zone in two districts (Fentale and Boset) of the mid rift valley of Ethiopia.

Bosetdistrictis located at a distance of 125 km from the capital city of Ethiopia, Addis Ababa and the district have semi-arid type of climate; an erratic, unreliable and low rain fall averaging between 600-900 mm per year at an altitude of 1400m-2500mas. The minimum and maximum annual temperatures are 15° and 30°C, respectively. The district is bounded by Fentale district at East, Adama district at West, Amhara region (minjar) at Norht-East Arsi Zone at South. Human populations in the area were 79,430 female, 77,682 male with a total of 157,112. Livestock population in the area was cattle 243,459, sheep 64,893, goat 189,516, Horse 10,050, Mule 758, donkey 42,555, Camel 28,980 and poultry 110,307. Pastoralism and agro-pastoralism are the main livelihood systems in the area. Major crops in the district (in order of importance) are maize, tomatoes, onions and teff from Livestock and fishery office of the district.

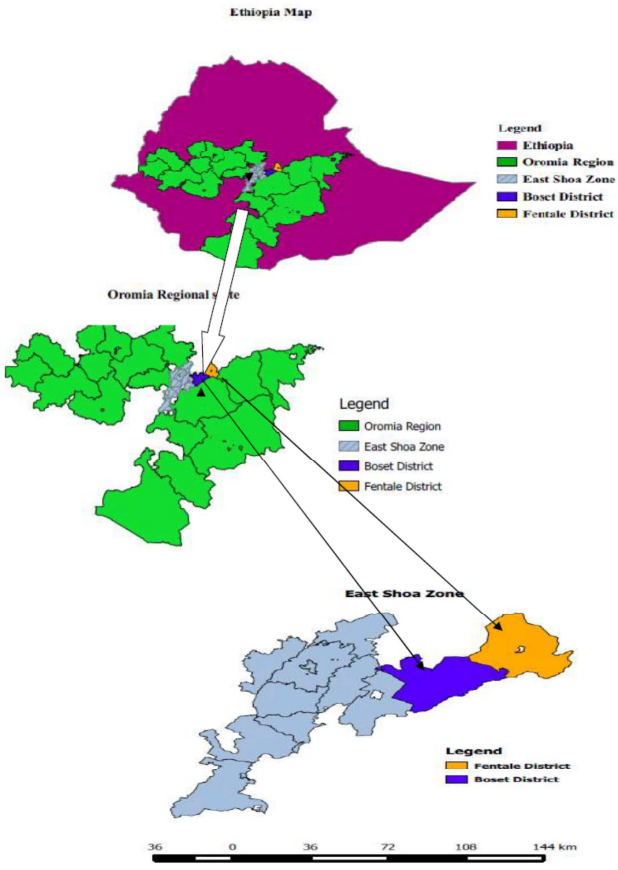

Figure 1. Map of the study area

Figure 1. *Map of the study area.*

Fentalle district is also located in east Shoa zone of Oromia, southern part of the northern Rift Valley of Ethiopia and the area falls within an altitude range of 800 to 1100 masl. However, there are high peaks on the Fentalle Mountain from which the district derives its name, reaching up to 2007 masl [2]. The district falls in a semi-arid zone, and receives an annual rainfall ranging from 400 to 700 mm. Temperature ranges from 29 to 38°Cand the district is found at a distance of about 200 km from the capital city of Ethiopia, Addis Ababa, on the way to Harar and bounded by Boset district at West, Afar region at East, Amhara region at South and East Arsi Zone at north. It is affected by recurrent droughts due to disrupted rainfall patterns. There are diverse livestock breeds and population including Cattle 53682, Sheep 106934, Goat 129424, Donkey 12293, Horse 516, Mule 4, camels 20290 and poultry 6446 and Human population of 59311 of these male 31662 and female 27,649 in the area.

Breeds

Arsi cattle are one of the indigenous breed/strains identified and included in the cattle breeds/strains list in the

country. The Arsi cattle are categorized under large East African Zebu cattle and distributed throughout the Arsi and Bale and also at some part of Shewa, up to the higher altitude of Sidama and West Harerghe and certain part of the low lands within the mid rift valley of Ethiopia [22, 31, 9].

Kereyu breeds are one of the indigenous livestock breeds whose adaptive traits permit survival and reproduction under the harsh climatic condition of the study areas. Regarding the origin of the breed, some respondents did not knew any history on the origin of the breed. However, some of the key informants tend to associate origin of the breed with that of the ethnic group maintaining kereyu breed. The breed is also named 'Doba'by the Kereyu people who keep the breed in the Fentalle district of east Shoa zone of Oromia, which is the major natural breeding tract of the breed [23].

3.2. Sampling Techniques and Methods of Data Collection

Multi-stage purposive sampling technique was employed for the selection of study districts and kebeles. Discussions were held with zonal Livestock and Fishery Development office experts in order to have information on breeds of cattle and its distribution in the districts of East Shoa zones, Fentale and Boset. Sampling districts were selected based on the presence of Arsi cattle and their distribution in the districts. The first stage was selection of districts based on potential and presence of Kereyu and Arsi cattle breed in adjacent area of East Shoa zone, then selection of three rural kebeles (PA) per district were undertaken.

A multistage sampling technique (both random and purposive) sampling procedure were used to select owner of the breeds, area of concentration of breeds in the study area, adjoining point of the two breeds and individual animal in the population. From each Kebele 10 Kereyu Sanga, Arsi and crossbred cattle owners were randomly selected for administration of semi-structured questionnaire.

3.3. Questionnaire and Group Discussion

A survey questionnaire for collecting data was designed with a scope limited to the objective of the study. Semi-structured questionnaire was designed to assess the socio-economic practices of thecommunity including cattle husbandry practices such as feeds and feeding, source of water, disease and disease control methods, livestock production system, factors affecting cattle reproduction and production performance (change of rainy season, drought, and degradation of grazing land) and difference between the breeds and preference of the farmer in Boset and Fentale district. Information on the production and reproduction performance including age at first mating, age at first calving, number of calf produced per cow's, life time and calving intervals were assessed using designed questionnaire from 30 selected respondents in each district. Key informant interview with 22 and 19 livestock husbandry those in Boset and Fentale, respectively was undertaken to cross check the information gathered through questionnaires.

3.4. Performance Monitoring

Data on milk yield, birth weight, weaning weight were taken during the study time of Boset district. Sixty five Cows of third parity which are in late pregnant stage were selected in advance and from these 30 of them were gave birth on interval of 1-6 days in October 2017 then they are selected and their milk yield was collected daily at morning and night using calibrated cylinders. The birth weight and weaning weight of calf was also taken using simple weighing balance and sack.

Performance monitoring on milk yield, birth and weaning weight were undertaken by taking 10 lactating animals of each breed and crossbred with a total of 30 animals in Boset district in which all the breeds are found in their breeding tract of the same environment. The monitoring was done starting from October up to end of January 2018 for three months.

3.5. Statistical Data Analysis

All the collected data were analyzed to compute the mean, standard deviation and coefficient of variance of each measurement. General linear model (GLM) SAS, 2008 procedure was employed for analysis of quantitative variables to detect statistical differences between sampled cattle population in the study areas. Quantitative traits measured were analyzed using statistical analysis system (SAS 9.2, version 2008). For the significant difference observed between sample means, Dunkens test was used for mean comparisons. The degree of association between all pairs of metric variables was also computed for each breed using SASCORR procedure of SAS. The SPSS statistical software (Ver. 20) was used to analyze qualitative survey data. The results pertaining to the survey were analyzed using Chi square test.

The model used for the analysis of productivity (Milk yield, Birth weight and Weaning weight) and reproductive traits was:

$$Yij=\mu +Bj + eij$$

Where: Yijk=observed value of trait of interest
μ=overall mean
Bi=fixed effect of breed
eij=residual random error associated with the $[ijk]^{th}$ observation

4. Results and Discussion

4.1. Socio-economic Characteristics of Households

4.1.1. Age of the Respondents

As age of the respondents and family size indicated inthe Table 1 below; Age of the respondents was between 34-60 years old with mean of 42.78±6.27 years. The p-value for the family size was $P<0.05$ which indicates significance differences of average family size per household in the two districts. This shows higher family size in Fentale than Boset. The reason of having higher family size in Fentale district was due to the perception of the ethnic group that having

high family size is agood gift of GOD and the pastoral practice of polygamy

Table 1. *Age and family size (Mean±S. E) of the respondents in study areas.*

District	Age (yr.) X^2	Family size (No) X^2
Boset	42.43±1.23	6.36^{b}±0.23
Fentale	43.13±1.05	8.23^{a}±0.36
Total	42.78±800.68 (ns)	6.30±0.240.000 (sig)

*The different superscript indicate the variation between sample means.

Study of Abera Gemechu [1] indicated that, after a period of time larger family size would result in classification of farm land by distributing among family number which can have negative consequences on the living standard of parents over time. Thus, there could be a need for implementing family planning activities in the study area, which can thereby improve the overall family income. As observed in this study the overall family size was lower than reported by Alemayehu M. [4] from Borana area.

4.1.2. Sex, Source of Income and Educational Level of Respondents

As indicated in Table 2below, majority of the respondents were male headed households in the two study areas. There was higher illiterate respondents in Fentale than Boset, which was significant (P<0.05) difference. The presence of more illiterate simply indicates either less access of the community to education service or the life style of the pastoral community. Hence the Federal and regional government should design and implement appropriate education access in the area. Due to high number of illiterate respondents in Fentale the adoption of new agricultural technology was hindered in the district. the same result reported by Shiferaw Garoma, Workneh Ayalew and P. B. Hegde [24] in the district 90% illiterate respondents. This percentage of illiterate respondents in Fentale district in the current study was very higher than previous studies reported average illiterate respondents of 42 and 42.65% in the pastoral area of Shebele zone and the southern periphery of the country, Guji zone, Odo-Shakiso and Adola districts, respectively [1].

Table 2. *Sex of the respondents, Educational Level and source of income in the studied area.*

Response category		Districts		
		Boset N (%)	Fentale N (%)	Total N (%)
	Male	21^{a} (70.0%)	22^{a} (73.3%)	43 (71.7)
	Female	9^{a} (30.0%)	8^{a} (26.7%)	17 (28.3)
Total		30 (100%)	30 (100%)	60 (100)
	Illiterate	10^{a} (33.3%)	19^{b} (63.3%)	29 (48.3)
Education	Read &write	11^{a} (36.7%)	9^{a} (30.0%)	20 (33.3)
	Primary school	5^{a} (16.7%)	2^{a} (6.7%)	7 (11.7)
	Second school	4^{a} (13.3%)	0^{b} (0.0%)	4 (6.7)
	Total	30 (100.0%)	30 (100.0%)	60 (100)
Source of income				
Livestock production only		2^{a} (6.7)	27^{b} (90)	29 (48.3)
Livestock Crop Production		16^{a} (53.3)	1^{b} (3.3)	17 (28.3)
Livestock and off farm source		12^{a} (40)	2^{b} (6.7)	14 (23.3)
Total		30 (100)	30 (100)	60 (100)

The different superscript indicate the variation between sample means.

4.2. Cattle Production System

As indicated in the Table 3 below Livestock production system in the two districts were significantly (P-Value<0.05)) different and majority of the respondents in Fentale were pastoralists with few agro-pastoral. Whereas in Boset district 75% of the respondents were crop-livestock mixed production system and 1/3 of them was agro-pastoral. Themajor crops cultivated by agro-pastoral respondents in Fentale district were maize and sorghum in small amounts, which was similar with the study of Shiferaw G. [23]. In the group discussion with the respondents of Fentale district it is revealed that there was no any intervention in animal health, animal production and in all livestock activities.

Table 3. *Livestock production system in the study area.*

Districts		Livestock production systems			
		Crop livestock production	Agro pastoralist	Pastoralist	Total
Boset	N	21	9	0	30
	%	70%	30%	0%	10%
Fentale	N	0	2	28	30
	%	0.00%	6.70%	93.30%	100%
Total	N	21	11	28	60
	% of	35.00%	18.30%	46.70%	100%

The different superscript indicate the variation between sample means (P-Value 0.000).

4.2.1. Livestock Possession and Herd Structure

The livestock possession of the study areas was significant ($P<0.05$) difference in livestock number of the study area which was higher in Fentale for sheep, cattle, goat, and camel number than Boset district. While higher number of chicken and horse were found in Boset district than Fentale districts. High number of cattle is ascribed to the importance of cattle in the overall farming economy, availability of farm lands year round and inputs [16]. High possession of livestock in Fentale show that majority of the respondents were pastoralist they depend on livestock production than crop. Landholdings were higher and that the land allocated to grazing was also higher in Fentale than Boset due to more land allocation for cultivated land in Bosetdistricts. The numbers of chicken and horse are higher in Boset which can be ascribed to their adaptability to the agro ecologies and farming practices. Equines are mainly kept for transportation purposes. This study indicates the presence of high number of camels and ruminant species per household which require attention from agricultural development stakeholders.

Table 4. *Livestock possession of the respondents in the two districts (head/HH).*

Woreda		Number of cattle	number of goat	number of sheep	number of donkey	number of chicken	number of horse	number of camel
	Mean±SE	27.16±1.52	25.1±1.99	20.03±0.82	3.83±0.38	21.10±0.61	0.46±0.11	3.33±0.96
Boset	Min	10	15	10	0	17	0	0
	Max	47	60	31	7	29	2	16
	Mean±SE	34.76±1.84	34.70±2.59	25.46±2.15	4.40±0.40	15.23±1.27	0.06±0.04	9.33±1.17
Fentale	Min	18	14	11	0	0	0	0
	Max	65	75	50	7	24	1	21
	Mean±SE	30.96±1.28	29.9±1.73	22.75±1.19	4.11±0.28	18.16±0.79	0.26±0.06	6.33±0.85
Total	Min	10	14	10	0	0	0	0
	Max	65	75	50	7	29	2	21
P value		0.002	0.005	0.022	0.320	0.000	0.002	0.000

SD=Standard deviation, Min=Minimum number of livestock respondents own, Max=Maximum number of livestock respondents own.

Table 5. *Feed resource and feeding management of livestock.*

	Districts			
	Boset N (%)	Fentale N (%)	Total N (%)	
Major livestock feed resource in the districts				X^2
Natural Pasture	15^a (50)	23^b (76.7)	38 (63.3)	
Natural pasture and crop residue	15^a (50)	7^b (23.3)	22 (36.7)	0.032
Major feed resource during dry season				X^2
Natural pasture only	12^a (40)	19^a (61.3)	41 (51.7)	
Natural pasture and crop by products	14^a (46.7)	3^b (10)	17 (28.3)	0.007
Natural pasture and industrial by products	4^a (13.3)	8^a (26.7)	12 (20.2)	
How do you overcome during feed shortage				X^2
Migrating with cattle	3^a (10)	23^b (76.7)	26 (43.3)	
Searching available feeds from other place	17^a (56.7)	4^b (13.3)	21 (35.2)	0.000
Buying industrial by products	10^a (33.3)	3^b (10)	13 (21.5)	

The different superscript indicate the variation between sample means.

4.2.2. Livestock Population Trend

The Kereyu breed derives its name from the Fentale areas of the ethnic group of the people that maintains it. According to group discussion with key informants Fentale district is the main natural breeding tract of Kereyu breed. Moreover, the Kereyu breed of cattle is also found in other neighbor districts of east shoa zone like Boset and Dugda. On the other hand, majority of Arsi breeds are found in Arsi zones of Oromia region. Besides, they are found in some districts of east shoa zone such as Boset, Fentale, Adami Tulu Jidokombolcha and Dugda districts. In the Fentale district of the study area the majority of the people rear Kereyu breed of cattle for income generating, food for consumption (milk and meat) and saving. But in Fentale district the communities do not consider maintaining Arsi cattle breed as saving or asset because this breed is less productive and susceptible to recurrent draught and diseases in comparison to Kereyu cattle. In Boset districts both Arsi and kereyu breeds were used for multipurpose activities such as income generating, draught power and milk and meat production.

4.2.3. Feed and Feeding Management for Cattle

Depending on the findings, majority of the Fentale district respondents were pastoralists and they migrate especially with their cattle and camel during dry season and feed scarcity. The small ruminants stay around their temporary home. So they depend on grazing natural pasture and few of them supplement with industrial by product of sugar from Matahara sugar factory and maize stover. In Boset district, the respondents use natural grazing and store crop residue to feed their livestock during dry season because majority of the respondents practiced crop cultivation in addition to livestock production. The use of natural pasture as a primary source of feed for livestock in the study area was similar with the findings of Ayantu Mekonnen, Ayenale Haile, Taddele Dessie and Yosef Mekasha [7] from Western Oromia. However, over the years the size of natural pastures was shrinking in the

study area due to occupation of the land by irrigation. Besides, due to higher grazing pressure, the grazing land was degraded. The same result was reported for this area by a recently study [5]. Hence the pastorals in Fentale district need to be made aware of the methods of pasture conservation besides advocating better grazing management.

Table 6. *Source of water for livestock in the study area.*

Districts	Boset	Fentale
Variables	N%	N%
Rivers only	1136.7	0
Dams only	826.6	0
Water harvested from rain	0	1756.7
Rivers and Dams	1136.7	1343.3
Total	30100%	30100%

4.2.4. Water Source and Watering Management

Source of water for livestock in the study area is indicated in Table 6. The source of water in Fentale district for livestock even for the people especially in the PA of Kobo and Banti was water harvested from rain in the pond in wet season whereas in Boset district most of water source was from dams used for irrigation of sugar plantation and rivers. This study shows that development activities with regard to water for human and livestock were neglected in the study area. Water was the most important nutrients vital for all physiological and biochemical process of livestock which can hinder growth and reduce productivity.

The results from the study indicated that water harvested from rain during rainy season, dams, river and pond (bore well) were the important water sources in dry season.

4.2.5. Cattle Breeding Practices in the Study Area

There was significant difference on selection and castration of bull in the two districts. Majority of the respondents in Boset district practiced selection and culling of bulls than Fentaledistrict. The study shows that culling of animals in different methods was common among the respondents. Majority of the respondents done culling by selling live animals and slaughtering. From these activities selling of low productive and diseased animals was common. The culled cattle were generally sold off to earn extra cash by the households. Similar to current study [7] farmers in Horro district have developed culling mechanism for maintaining the desired quality of animals. The author also indicated that culling of male animal is done at age of seven year 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 [7, 10]. A report by Solomon Takele [26] about Boran pastoralist and agro pastoralist also indicated the same method of culling of Boran cattle from the herd is employed. As indicated in Table 8 below, selection of breeding bull, breeding female, castrating bull and culling of low performing animals is highly practiced in Boset district than Fentale. This indicated that peoples in Boset district have good awareness in livestock management and breeding.

Table 7. *Cattle breeding practice of the respondents in the study area.*

		Districts		
		Boset	Fentale Total	
		N (%)	N (%)	N (%)
Do you select breeding bull	Yes	21^{a} (70)	11^{b} (36.7)	33 (36.7)
	No	9^{a} (30)	19^{b} (63.3)	28 (63.3)
Do you select breeding female	Yes	14^{a} (46.7)	12^{a} (40)	26 (40)
	No	16^{a} (53.3)	18^{a} (60)	34 (60)
Do you castrate bull	Yes	21^{a} (70)	11^{b} (36.7)	22 (36.7)
	No	9^{a} (30)	19^{b} (63.3)	28 (63.3)
Do you cull low performing Animal	Yes	12^{a} (40)	6^{a} (20)	18 (20)
	No	18^{a} (60)	24^{a} (80)	42 (80)
Methods of culling used				
Selling of live animals		10^{a} (83.3)	6^{a} (100)	16 (88.9)
Slaughtering		2^{a} (16.7)	0^{a} (0)	2 (11.1)

N: number of respondents in the studied location.

Selection criteria for the bulls and cows reported by the respondents were presented in Tables 12 below. The findings indicated that the bulls were selected based on their body size, physical appearance, dam performances and docility. Body size was preferred by respondents because it has a primordial importance since it is correlated with masculinity and such bulls usually could have a high carcass yield [18]. The result of this study was in close accordance with the observations [29]. The second most important trait which is considered for selection are the physical appearance traits and overall view of the bulls. Bulls with even slight physical deformities are not preferred [29]. The performance of the dam as a selection criterion indicates that the respondents were aware of the transmission of the dairy related traits from the dam to the bull calves [7]. Dairy related traits are moderately heritable and therefore the information from the female relatives can serve as an indication of the transmission ability of the trait by the male offspring [3]. The study further indicates that docility was also taken as criteria for selection of the bulls as docile bulls are easy to manage and hence are expected to have a very good temperament which is also easy for the owners'. similar result the same selection criteria for Arsi breed in central highlands. The results pertaining to the selection of the cows are presented in Table 8. Cows are selected based on their milk production, reproduction fitness,

body size and their physical appearances. The cows are selected based on their milk yield which is in close accordance with that reported by Endashaw Terefe [12] This is because, the cows with good milk yield can nurse strong claves and also some extra milk can be made available to the family members [7] Cows with long body usually have higher abdominal space for the growing foetusand cows with wide pelvic region have lower incidences of non-specified abortion [17]. Moreover, studies have indicated that cows with longer and larger body require higher maintenance but can be correlated with high milk yield [3] Results refer tothe physical appearance are correlated with the feminity of the cows which include well developed udder, milk veins, thin and long neck besides rounded barrel [3] with good physical appearances' to also have a pleasing effect on their owners and also on the social hierarchy of the herd [27].

Table 8. *Selection practices of Caws and bulls.*

Bull	Districts			
	Boset		Fentale	
	Index	Rank	Index	Rank
Body size	0.35	1	0.34	1
Physical appearance	0.23	2	0.26	2
Dam performance	0.21	3	0.14	4
Docility	0.17	4	0.09	5
Color	0.04	5	0.17	3
Cow				
Body size	0.17	3	0.19	3
Physical appearance	0.15	4	0.14	4
Milk yield	0.27	1	0.26	1
Reproductive fitness	0.24	2	0.22	2
Dam performance	0.13	5	0.11	5
Docility	0.07	6	0.08	6

4.3. Effect of Climate Change on Cattle breeds Performance and Their Adaptive Characteristics as Perceived by Respondents

The findings indicated in Table 9 show that the change in climatic condition in the study location such as long dry season, short rainy season, high temperature in the past decades affect livestock productivity and life span of livestock. In the study location reduction of milk production was the major impact of climatic change in both districts as discussed with key informants and from interviewed respondents. There is an increase in temperature as compared to past decades and long dry season is common than before due to deforestation for investment purpose and charcoal preparation under such condition respondents said that animals cannot produce much milk even its difficult to survive. However climate change has little effect to impose calving difficulty. From group discussion with key informants, Kereyu cattle breed was more preferable than Arsi and their cross breed in Boset and Fentale districts. Similar preference for Kereyu breed were reported in Fentale district [24]. The reason is that Kereyu breed are the most adaptive breed to the agro ecology of the area with shortage of water, long dry season (draught), shortage of feed, high temperature and also able to move long distance in that harsh environment. In Boset district, the respondents prefer to cross the Arsi breed with Kereyu. This was because the Arsi breed is perceived by farmers to be more affected during occurrences of long draught.

The findings depicted in Table 10 shows that Kereyu cattle breed are mostly adaptive and withstand shortage of feed, shortage of water, resistance to disease and tolerate heat. While crosses and Arsi breed cattle's were moderately adaptive and less adapted, respectively. Due to this majority of the respondents prefer to keep Kereyu cattle breed than other breeds. Regarding Arsi breed in studied areas especially in Boset district the respondents practiced crossing with Kereyu cattle to improve the adaptive ability of the cattle. Next to kereyu cattle breed, cross of other breeds with kereyu cattle is moderately adapted to the area.

Table 9. *Effect of climate change on cattle production and reproduction.*

Boset								Fentale						
	1	2	3	4		Index	Rank	1	2	3	4		Index	Rank
To production														
WL	14	16	0	0	104	0.34	2nd	6	19	3	2	89	0.29	2nd
LMP	16	13	1	0	105	0.36	1st	24	5	1	0	113	0.38	1st
LMV	0	1	29	0	61	0.20	3rd	0	6	24	0	66	0.23	3rd
CD	0	0	0	30	30	0.1	4th	0	0	2	28	32	0.10	4th
To Reproduction														
PC	11	14	3	2	94	0.31	2nd	14	13	2	1	100	0.33	1st
LCI	16	8	4	2	98	0.33	1st	12	14	4	0	98	0.32	2nd
Abortion	3	8	17	2	72	0.24	3rd	4	3	19	4	67	0.23	3rd
LPA	0	0	6	24	36	0.12	4th	0	0	5	25	35	0.12	4th

WL: Weight loss, LMP: Low milk production, LMV: Low market value, CD: Calving difficulty, PC: Poor calf, LCI: Long calving interval, LPA: Late puberty age.

Table 10. *Adaptive capacity of the breeds in the study location.*

Adaptive traits	Level of tolerance of the breeds								
	Good			Moderate			Less		
	Kereyu N (%)	Cross N (%)	Arsi N (%)	Kereyu N (%)	Cross N (%)	Arsi N (%)	Kereyu N (%)	Cross N (%)	Arsi N (%)
Heat tolerance	58 (96.7)	2 (3.3)	0	2 (3.4)	50 (83.3)	8 (13.3)	0	8 (13.30	52 (86.7)
Draught tolerance	60 (100)	0	0	0	55 (91.7)	5 (8.3)	5 (8.3)	0	55 (91.7)
Withstand shortage of feed	60 (100)	0	0	0	56 (93.3)	4 (6.7)	0	4 (6.7)	56 (93.3)
Withstand shortage of water	60 (100)	0	0	0	60 (100)	0	0	0	0
Disease resistance	60 (100)	0	0	0	60 (100)	0	0	0	60 (100)

N: number of respondents in the studied location.

4.4. Major Constraints of Livestock Production

The major constraints of cattle production in the study area is indicated in Table 11. Fentale and Boset districts are found in the rift valley in which scarcity of water was a common problem due to shortage of seasonal rainfall during the past decades. Hence, feed shortage and water scarcity were the major problem in their order of importance, and due to absence of feed and water diseases also rank the third among the major problems in the study area. This result was consistent with the study by Asrata A, Yilma Z and Nurfeta A [6] who indicates that shortages of feed and water were the major constraints in southern part of Ethiopia. This indicates that due to large number of livestock and scarcity of water and feed the productivity of indigenous animals were low.

Table 11. *The major constraints of cattle production in the study area.*

Constraints	Boset			Fentale		
	N (%)	Ran	Index	N (%)	Rank	Index
Feed shortage	30	1	0.55	35	1	0.52
Water shortage	17	2	0.25	20	2	0.33
Disease	10	3	0.20	5	3	0.15

4.5. Production and Reproductive Performance of the Breeds

4.5.1. Growth Performance of the Breeds

The average growth performance of Kereyu, Arsi and their crosses are indicated in Table 12. The overall mean birth weight of Kereyu, Arsi and their cross calves were 19.50±2.01, 17.7±1.56, 18.70±1.76 kgs, respectively in (Table 13). Compared to the birth weight observed for Boran calves, the estimated birth weight of Kereyu calves is less than reported value of 23.7±0.7 kg. The estimated birth weight of Arsi breed and cross ofArsi breed and Kereyu in Boset district is less than the birth weight of 19.3 kg recorded for Horro breed [14]. The results as recorded are however lower than that recorded by Takele T. [28] for Sheko breed while the reverse was true for Horro cattle [10] reared in BakoTibe and GobuSayo districts of Oromia Region.

4.5.2. Milk Yield

The findings indicated that the performance of the breeds generated through discussion and interviewed respondents were comparable with that of monitored in Boset district for performance evaluation of milk yield, birth weight and weaning weight. The performance of the breeds were significantly ($p<0.05$) different in DMY and LMY and performance of Arsi, Kereyu and crossbred 'maya' in Boset were better than those in Fentale district. The result indicated milk yield and lactation milk yield were smaller when compared with other zebu cattle. Begait third parity (2.65+0.41 and 465.56+9.02) while higher lactation length than Begait (5.83+0.04) in western Tigrayi. The result shows the milk yield of third lactation of kereyu breed is comparable with that reported by of Bonga cattle (1.98+0.06) but lower lactation length ofKereyu, Arsi and Crossbred 'maya' that of Bonga cattle (8.42+0.27). And lower when compared with findings of Shiferaw G. [23].

With lactation length (8.53+2.25), daily milk yield (1.8+0.54) and lactation milk yield (463.1+189.72) for third parity of Kereyu breed. Generally, Kereyu breed is higher performing breed in both districts and Followed by crossbred 'maya' of their F1 while Arsi breed is least performing in the two districts.

Table 12. *Performance of the cattle generated from respondents.*

District									
	Boset	Fentale		Boset	Fentale		Boset	Fentale	
Variable	Arsi	Arsi	P-V	Kereyu	Kereyu	P-V	AxK	AxK	P-V
LL (mon)	6.97^{a}±0.08	5.76^{b}±0.09	0	7.63^{a}±0.08	7.40^{a}±0.01	0.092	7.40^{a}±0.09	6.83^{b}±0.09	0
DMY (lit)	1.33^{a}±0.08	1.20^{a}±0.07	0.25	1.76^{a}±0.10	1.66^{a}±0.09	0.49	1.50^{a}±0.08	1.36^{a}±0.10	0.329
LMY (lit)	278.10^{a}±1.5	207.36^{b}±1.80		402.86^{a}±0.87	368.52^{b}±0.51		333.00^{a}±1.05	278.66^{b}±0.90	
AFM (year)	3.95^{a}±0.02	3.76^{b}±0.04	0	3.85^{a}±0.04	3.71^{b}±0.04	0.038	4.00^{a}±0.00	3.73^{b}±0.03	0

CV: Coefficient of variation, S. D: standard deviation**,** LL: lactation Length, DMY: Daily milk yield, LMY: Lactation Milk yield.

Table 13. *Productive and reproductive performance evaluation in Boset district.*

Breeds	Boset								
	Daily milk Yield			Birth weight			Weaning weight		
	DMY (lit)	LL (d)	LMY	M±SE	V	CV	M±SE	V	CV
Arsi	1.4±0.35^{c}	250	350^{c}±87.5	17.7±1.56	2.45	8	78.4±5.52	31.62	7.71
Kereyu	1.9±0.33^{a}	250	475^{a}±82.5	19.50±2.01	4.05	10	92.20±7.11	50.62	7.17
Cross AXK	1.67±0.19^{b}	250	417.5^{b}±475	18.70±1.76	3.12	9	82.10±7.26	52.76	8.84

LL: lactation length, DMY: daily milk yield, LMY: lactation milk yield, AFM: age at first mating, Axk: cross of Arsi with Kereyu cattle, P-V: P-value.

The results pertaining to the production traits of Arsi, Kereyu, Crossbred of Arsi and Kereyu cows as presented in Table 13 below is indicative that there was difference in daily milk yield (DMY) and lactation milk yield (LMY) of the cows which was recorded to be higher for Kereyu cows reared in Bosetwhile Arsi cows and Crossbred cows of Arsi and Kereyu reared in the same district had the lowest *(P<0.05)* yield. The result shows the milk yield of third lactation of kereyu breed is comparable with Bonga cattle (1.98+0.06) but lower lactation length of Kereyu, Arsi and Crossbred 'maya' than that of Bonga cattle (8.42+0.27). And lower when compared with lactation length (8.53+2.25), daily milk yield (1.8+0.54) and lactation milk yield (463.1+189.72) for third parity of Kereyu breed in Fentale district [23]. Generally Kereyu breed is higher performing breed in both districts and Followed by crossbred 'maya' of their F1 while Arsi breed is a least performing in the two districts.

Table 14. *Reproductive performance of breeds in the districts.*

District						
	BosetFentale					
Traits	Arsi	Kereyu	Cross	Arsi	Kereyu	Cross
AFM (Mean±SE)	3.95+0.02	3.85+0.04	4.00+0.03	3.76+0.04	3.71+0.04	3.73+0.03
p-value	0.000*	0.038*	0.000*	0.000	0.038	0.000
AFC (Mean±SE)	4.55+0.02	4.40+0.04	4.50+0.03	4.78+0.04	4.64+0.04	4.79+0.03
P-value	0.001	0.038	0.000	0.001	0.038	0.000
CI (Mean±SE)	1.50+0.03	1.41+0.01	1.48+0.00	1.51+0.02	1.38+0.03	1.50+0.00
p-Value	0.031	0.023	0.000	0.031	0.023	0.000
LTCP (Mean±SE)	5.53+0.09	6.53+0.09	6.26+0.08	4.56+0.10	6.30+0.08	5.63+0.10
p-Value	0.000	0.069^{ns}	0.000	0.000	0.069^{ns}	0.000
RLTC (Mean±SE)	7.63+0.10	9.23+0.09	7.76+0.10	6.73+0.08	8.23+0.09	7.70+0.08
p-Value	0.000	0.000	0.621^{ns}	0.000	0.000	0.621^{ns}

AFM: Age first mating, AFC: age first calving, CI: calving interval, LTCP: life time calf production: RLTC: Reproductive Life time of cow.

4.6. Reproductive Performance

The results pertaining to the reproductive traits of the Arsi, Kereyu and cross of Arsi and Kereyu breed cattle reared in the study areas are presented in Table 14. The findings indicated that traits such as Age at First Mating (AFM) of heifers, Age at First Calving (AFC), Calving Interval (CI) reproductive life time of cow (RLTC) and life time calf production are significantly different among breeds (P<0.05) except for Kereyu breed which not vary (P>0.05) on life time calf production and reproductive life time of cow for crossbred cow (RLTC). The variation between same breed in different study areas were due to little variation in agro ecology in which the breed interact and also in Boset district the availability of feed, water and also production system of livestock was better than production system and availability of feed and water in Fentale district. AFM, AFC, CI, RLTC and LTCP were lower than reported by Shiferaw G. [23] which were 45.7 months (3.8 year), 54.1 months (4.54years), 9.2 years and lower in life time calf production (LTCP) and reproductive life time of cow which is 7 calves and 11 years for Kereyu breed in Fentale district.

The result in the study area also indicated that age at first mating (AFM), age at first calving (AFC) and calving interval were higher while lower in reproductive life time of cow and life time calf production for Bonga cattle at Kaffa Zone. The reproductive performances of Arsi cows indicated that there were differences in life time calf production (LTCP) and reproductive life time of cow in which the values were lower at Fentale and higher at Boset. This is due to the livestock production system in the area and resistance of the breed to harsh environments. Lower AFM, AFC and CI are ascribed to the management received by the cattle and agro ecology [23]. The AFM as result is in close accordance with that reported by Endashaw Terefe [12] for Mursi cattle, for Kerayu [23] cattle and for Arsi cattle while higher AFM was also reported by Tewolde Gebru, Sintayehu Yigrem, Sandip Banerjee [29] for Begait cattle from western Tigray. Similarly, age at first mating and age at first calving of Arsi, Kereyu and their crossbred 'Maya' is higher than that of Begait cattle and similar in calving interval (1.42+0.00) and life time of a cow (8.20+0.07 years) in Kefta HumerTigrayi.

The mean is computed to see a level of significance difference. P-value shows the level of the significance between reproductive traits of the breeds between districts.

5. Summery and Conclusion

Cattle genetic diversity in Ethiopia is currently under threat mainly due to unplanned breeding as well as indiscriminate cross breeding between exotic and indigenous and crossing between indigenous breeds, and interbreeding among the local populations. Many previous studies indicated low genetic variability which could be due to inbreeding (FIS=0.012) and uncontrolled mating practices that are common among the pastoral herds. Climate change likely affects the productive and reproductive performances of cattle, and consequently their population growth. The interbreeding undertaken among various cattle breeds by different communities may be ascribed to the need to develop breed that can withstand the impact of the current climate change on their original breed. The present study was carried outto examine morph metric variation between indigenous cattle breeds of Arsi, Kereyu and their crosses and evaluate adaptive, productive (milk yield) and reproductive performance of the breeds.

A total of 60 respondents were involved in the study area, 30 respondents were from Boset and the other 30 respondents involved from Fentale district. Majority of the respondents were male headed households (71.7%) and Female headed household of 28.3%. Most of the respondents in Fentale district were illiterate and no any respondents attended secondary school. The major livestock production constraints in the area are drought, disease, expansion of unwanted trees on grazing land and water scarcity. The overall mean livestock possession (head/HH) in the study area was 30.96, 29.9, 22.75, 4.11, 18.16, 0.26, and 6.33 for cattle, goat, sheep, donkey, chicken, horse and camel, respectively. The findings show that there was number of camel and chicken than others livestock. The main feed source were natural pasture, crop residues, industrial byproducts and concentrates. Water harvested from rain during rainy season, Dam and pond are the main water source during dry season.

Culling of animals in different methods was common among the herds owned by the respondents. The respondents were done these activities differently in the two districts by selling and slaughtering. Of these activities selling of low productive and diseased animals was common. The overall mean birth weight ofKereyu, Arsi and Cross of Arsi and Kereyu calves were 19.5±2.01, 17.7±1.56, 18.7±1.76kg, respectively. Generally Kereyu breed is higher performing breed in both districts and followed by crossbred 'maya' of their F1 while Arsi breed is a least performing in the two districts. The variation between same breed in different study areas were due to little variation on agro-ecology, availability of feed, water and production system of livestock.

6. Recommendation

a) Implementing Kereyu breed conservation strategy to avoid genetic dilution.
b) Community based breeding or nuclear breeding program should be implemented to improve genetic performance of the adaptive breed in the area.
c) The perception of the farmer and the result that indicate the variation between breeds in their adaptive capacity need further study harder to draw strong recommendation for future breed utilization and breed development.
d) Training and awareness creation for the livestock holder how to conserve and utilize other feed resources in the area during scarce period.

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