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Reproductive and productive performance of Kereyu Sanga cattle in Fentalle District of Oromia Region, Ethiopia

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This study was carried out to generate information on some productive and reproductive performance of Kereyu Sanga cattle in their home tract. The data was collected through questionnaire from 114 Kereyu Sanga cattle owners. Fifty four third parity lactating Kereyu Sanga cows were randomly selected for milk yield measurement. According to the respondents, the mean age at puberty, age at first calving, lactation length and calving interval for Kereyu Sanga cows were 47.5, 54.1, 8.5 and 18 months, respectively, with associated lifetime calf crop production of 7.1 and reproductive lifespan of 13.2 year. The overall fertility rate of Kereyu Sanga cows was 55.4%. The mean reported age at puberty and reproductive life span for Kereyu Sanga bulls were 49 months and 9.2 years, respectively. The mean reported daily and lactation milk yield of Kereyu sanga cows were 1.8 and 463.1 L, respectively, whereas the mean measured third parity daily and lactation milk yield were 2 and 543 L, respectively. The reported variations both in some productive and reproductive performance and the observed variations in measured milk yield among the individual animals under such harsh environment indicate the possibility of improving the performance of this adapted Sanga breed through selection in their home tract so as to enhance their contribution towards poverty alleviation.

Key words: Cattle, fertility, Kereyu Sanga breed, lactation, milk yield, reproduction.

INTRODUCTION

In the semi-arid area of Africa where livestock support livelihoods for the majority of the population, indigenous livestock breeds form the backbone of livestock production because of their ability to survive and reproduce under stressful tropical environments. Native livestock breeds are often regarded as unproductive. What is generally meant, however, is that such animals have low levels of output. Productivity implies some relationship between inputs and outputs whereas production is merely an output function. The cattle industry, in particular as producer of meat and milk, is very poor as evidenced by the annual growth rate of 1.8% for milk and 2.8% for meat (ILCA, 1993) which is far below the recommended average growth rate of 4.0% that is needed to meet the demand of the growing human population (Winrock International, 1992).

Indigenous livestock breeds whose adaptive traits permit survival and reproduction under the harsh climatic, nutritional and management conditions typically associated with resource-poor livestock keepers have been shown to outperform crossbreeds under such circumstances (Ayalew et al., 2003).

The Kereyu (Synonym: Doba as it is named and called by the Kereyu people) breed derives its name from

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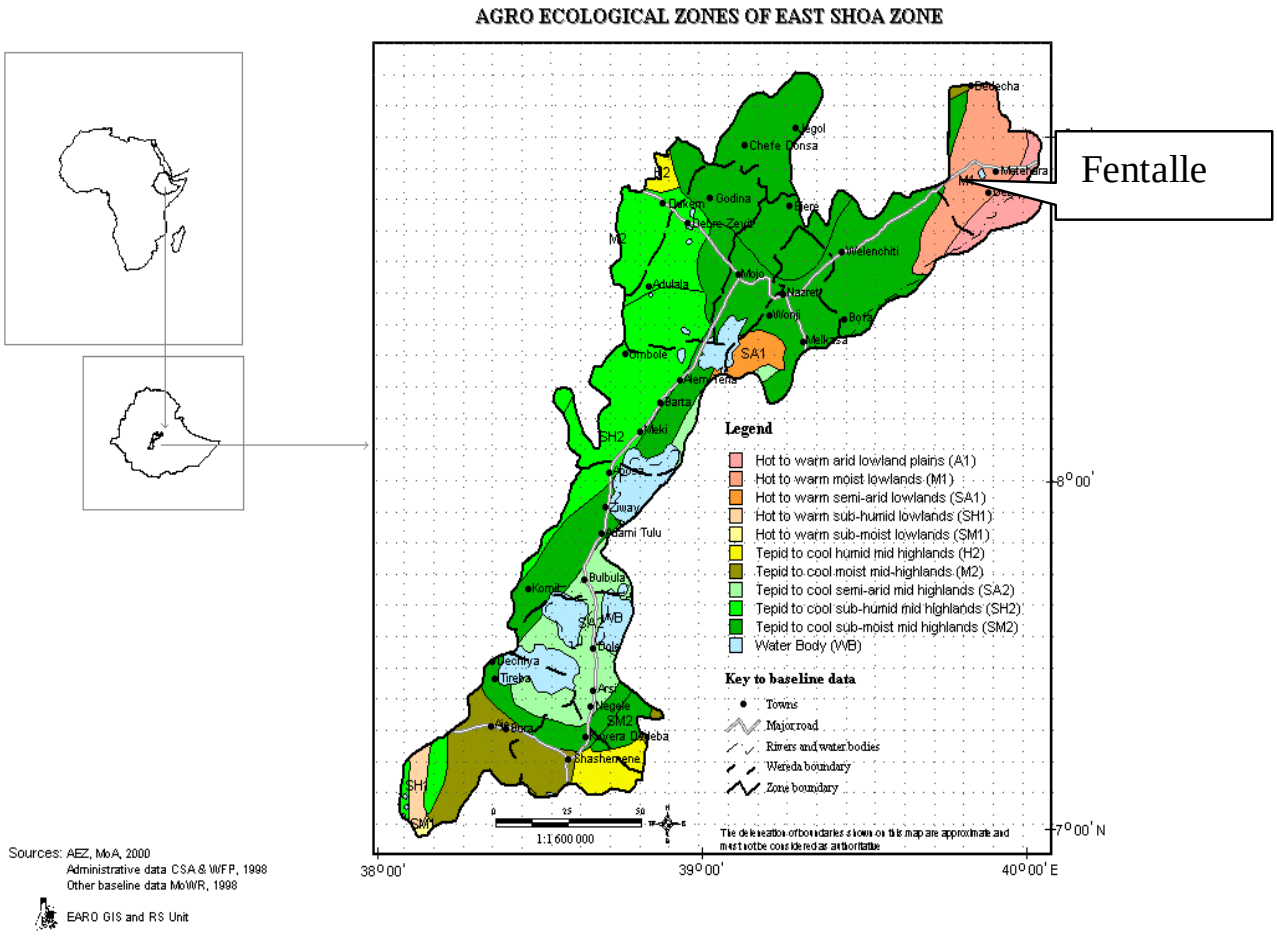

Figure 1. Map of east Shoa zone and Fentalle district.

Kereyu people who maintain the breed in the Fentalle district of east Shoa zone of Oromia, which is the major natural breeding tract of the breed. The breed is well-adapted to the extremely harsh condition of the area, where milk production plays a considerable role in the traditional economy of pastoral and agro-pastoral communities. They also serve as a source of draught power for the neighboring districts as well as beef.

The great advantages of the indigenous livestock of Ethiopia are their adaptation to the stressful environments and their ability to produce any output at all. The majority of the information that is available on indigenous cattle in Ethiopia is from on-station evaluation. Information on productive and reproductive performance of Kereyu cattle is scanty. Hence, this study was carried out to evaluate some reproductive and productive performance of Kereyu Sanga breed in their breeding tract.

MATERIALS AND METHODS

Study area

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 (Fentalle District Rural Development Office, Personal communication). Fentalle district is located in east Shoa zone of Oromia, southern part of the northern Rift Valley of Ethiopia (Figure 1). The area falls within an altitude range of 800-1100 masl. However, there are high peaks on the Fentalle Mountain from which the district derives its name, reaching up to 2007 masl (Abule, 2004). The study area is found at a distance of about 200 km from the capital city of Ethiopia, Addis Ababa, on the way to Harar. It is affected by recurrent droughts due to disrupted rainfall patterns.

The total land area of the district is 1170 km^2 (CSA, 2000). The study district falls in a semi-arid zone, and receives an annual rainfall ranging from 400 to 700 mm. Temperature ranges from 29 to 38°C. Agro-ecologically, the district falls in hot to warm moist lowlands. Fentalle district lies in one of the most geologically active areas of the world (Abule, 2004).

Sampling technique

To help determine the sampling frame, exploratory discussions were held with the experts of the rural and agricultural development office, with the representative of the pastoral community of the district and with the elderly Kereyu Sanga cattle owners to identify major production systems, concentration of Kereyu Sanga breed and cattle production constraints in the district. Currently, in Fentalle district there are 20 peasant associations (2 urban and 18 rural) of which 55.6 and 44.4% are agro-pastoral and pastoral, respectively.

Table 1. Summary of reported indicative reproductive performance for sample female cattle population by production systems.

Production system	Variable	Mean	SD	Minimum	Maximum	CV (%)
Pastoral (n=38)	Age at puberty (month)	41.7	7.63	24	60	18.3
	Age at first calving (month)	50.7	7.07	42	72	13.9
	*LTCP (number)	7	1.57	4	10	22.3
	Calving interval (month)	18	3.00	12	24	16.7
	Reproductive lifespan (year)	11	2.40	7	16	21.7
Agro-pastoral (n=76)	Age at puberty (month)	47.7	7.71	30	60	16.2
	Age at first calving (month)	55.8	9.13	42	84	16.4
	*LTCP (number)	7.0	1.91	3	11	27.2
	Calving interval (month)	18	3.43	12	24	19.0
	Reproductive lifespan (year)	14.3	4.13	5	23	28.9
Overall	Age at puberty (month)	45.7	8.16	24	60	17.9
	Age at first calving (month)	54.1	8.81	42	84	16.3
	*LTCP (number)	7.1	1.79	3	11	25.6
	Calving interval (month)	18.0	3.28	12	24	18.2
	Reproductive lifespan (year)	13.2	3.95	5	23	29.9

*LTCP = Lifetime calf crop production.

Based on the outcome of the discussions, a total of three peasant associations (PAs), one from pastoral and two from agro pastoral production systems were purposively selected for the study. From each site 19 Kereyu Sanga cattle owners were randomly selected for administration of semi-structured questionnaire. Fifty four lactating Kereyu Sanga cows were randomly selected for milk yield measurement to estimate the daily and lactation milk yield of the sample animals and to verify what has been reported by the respondents. All the selected lactating cows were in their third parity at different lactation stages (early, mid and late). Each lactation stage comprised 18 milking cows.

Method of data collection

In each sampling site, the selected cattle owners were briefed about the importance and objectives of the study before the commencement of the actual data collection. Data was collected by six trained enumerators through the designed and pre-tested semi-structured questionnaires from 114 randomly selected households under close supervision of the researcher. The milk yield of the 54 selected cows was measured using plastic measuring cylinder (with the measuring capacity of 1000 ml) twice a day, morning and evening, from each lactation stage (early, mid and late lactation). The period the milk yield measured was dry season.

Data management and analysis

The data collected from the field through questionnaire and milk yield measurements and secondary sources were entered into computer using Excel software. SAS (1999) was employed to analyze the data using descriptive statistics, including summary statistics, correlations and frequency counts.

RESULTS AND DISCUSSION

Purposes of keeping Kereyu cattle

In both pastoral and agro-pastoral systems Kereyu cattle are kept for multipurpose functions. Milk (98.2%), source of income (97.4%), dowry payment (80.7%), breeding (78.1%), meat (57%), hide (55.3%) and saving (52.6%) were among the frequently reported reasons for which Kereyu cattle are kept in the study areas. Similar results were reported earlier by Mukasa-Mugerwa et al. (1989) and Rege et al. (2001) in Ethiopia and Kenya, respectively. In developing countries, especially in low input smallholder production systems, the most valuable livestock attributes are often those that successfully guarantee multifunctionality, flexibility and resilience in order to deal with variable environmental conditions.

Reproductive performance

The average reported age at sexual maturity for Kereyu female and male cattle were 45.7 (Table 1) and 49 (Table 4) months, respectively, which are longer than the recent on-farm survey report for indigenous cattle breeds. Workneh and Rowlands (2004) reported the overall mean sexual maturity of 39.6 months for female and 39.9 months for male of indigenous cattle of Oromia Regional State. The same authors reported the mean age at sexual maturity of 41.7 for female and 42.5 months for male in pastoral production system and 43.3 months for female and 45.6 months for males in agro pastoral production system. Zewdu (2004) reported age at sexual maturity of 55.6, 57 and 55.7 months for Semien, Wegera and Mahibere-Sillasie breeding bulls which are slightly longer than the reported age at sexual maturity for Kereyu breeding bulls.

The overall reported mean age at first calving (AFC) for Kereyu breeding females was 54.1 months. Similar age was reported for some indigenous cattle types by different authors. Takele (2005) reported 54.1 months for

Table 2. Correlation matrix of reported reproductive traits in female cattle population sample.

Parameter	AAP	AFC	LTCP	CI	RLP
AAP		0.81 (<0.0001)	0.02 (0.8550)	0.21 (0.0267)	0.34 (0.0002)
AFC			0.02 (0.8005)	0.25 (0.0080)	0.28 (0.0021)
LTCP				0.02 (0.8372)	0.39 (<0.0001)
CI					0.25 (0.0071)
RLP					

AAP = Age at puberty, AFC = age at first calving, LTCP = lifetime calf crop production, CI = calving interval, RLP = reproductive lifespan.

Table 3. Summary of some indicative reproductive performance for male cattle population sample.

Production system	Variable*	Mean	SD	Min	Max	CV (%)
	AAP (month)	47.5	6.60	30	60	13.9
Pastoral (n=38)	RLP (year)	8.3	1.63	5	13	19.6
	AAC (year)	5.8	0.97	4	7	16.8
	AAP (month)	49.7	6.32	30	60	12.7
Agro-pastoral (n=76)	RLP (year)	9.6	2.59	5	14	26.9
	AAC (year)	5.2	1.16	2	8	22.1
	AAP (month)	49.0	6.47	30	60	13.2
Overall (n=114)	RLP (year)	9.2	2.39	5	14	26.0
	AAC (year)	5.4	1.12	2	8	20.7

* AAP = Age at puberty, RLP= reproductive lifespan, AAC = age at castration.

Sheko breed whereas, Dereje (2005) reported 53.1 months for Raya-Sanga cattle. Similarly, Zewdu (2004) reported 54.7 and 53.4 months of age at first calving for Wegera and Fogera cattle, respectively. Mekonnen and Goshu (1987) and Enyew (1992) reported a lot shorter AFC on-station of 32.8 and 38.8 months for Arsi and Fogera cattle, respectively. Mekonnen (1994) and Kassa and Arnason (1986) reported average age at first calving of 41.5 and 45.2 months, respectively for Borana cattle.

The longer average age at first calving reported for Kereyu cattle might be associated with scarcity of feed and shortage of water for the long dry season of the year in the study area. Regardless of the breed, the association of feed availability with attaining age at first calving for heifers was reported (Kiwuwa et al., 1983).

The average calving interval for Kereyu cattle was 18 months (Table 3), which was longer than what had been reported by Takele (2005) for Sheko cows (15.6 month) and by Dereje (2005) for Wello highland zebu cattle (16 months) but slightly lower than Raya Sanga cattle (19 month). Zewdu (2004) reported similar calving interval for Wegera (17.5 month) and Fogera (17.3 month) cattle whereas longer calving interval for Semien (22.4 month) cattle. The range calving interval estimates for Kereyu cattle (12-24 months) was within the range of the earlier estimates of calving intervals for Ethiopian zebu cattle of 12.2 to 26.6 months (Mukasa-Mugerwa and Azage, 1991). The mean reported reproductive lifespan of Kereyu breeding female was 13.2 years with associated lifetime calf crop production of 7.1. These values are slightly lower than what has been reported by Takele (2005) for Sheko breed.

The analysis of the correlation matrix (Table 2) indicates that most of the reported fertility traits considered in this study showed from low to high positivecorrelations. The strongest relationship was between age at puberty and age at first calving (r = 0.81, P<0.0001). Age at puberty was positively correlated with the reproductive lifespan of the animal (r = 0.34, P = 0.0002) indicating that reducing age at first calving would increase the reproductive lifespan of a cow. Lifetime calf crop production was positively correlated with the reproductive lifespan of the animal (r =0.39, P<0.0001) indicating the possibility of improving both fertility traits through improved management (feeding, health care or breeding). Fertility measures were reported to be closely related to each other (Kadarmideen et al., 2000). However, the correlation of lifetime calf crop production with the rest of the fertility traits considered in this study was found to be very minimal. This might be due to the small sample size, size of the variance (Table 1) and some unexplained factors.

Age at puberty and age at first calving were slightly shorter in pastoral area than in agro-pastoral probably due to their proximity to the bordering rangelands and their grazing areas are relatively better than that of the agro-pastoral. The mean reported reproductive lifespan of Kereyu breeding bulls was 9.2 year which is longer than the reported value (6.5 year) for Sheko breeding

Table 4. Summary of first, second and third parity lactation milk yield as reported by sample households.

Parity	Variable	Mean	SD	Min	Max	CV (%)
	Lactation length (month)	8.2	2.34	3	12	28.4
First	Lactation daily milk yield (liter)	1.4	0.53	0.4	3	39.2
	Lactation milk yield (liter)	329.4	161.53	90	900	49.0
	Lactation length (month)	8.6	2.24	4	12	26.2
Second	Lactation daily milk yield (liter)	1.9	0.63	0.6	3.3	33.0
	Lactation milk yield (liter)	490.9	217.72	84.0	1089	44.3
	Lactation length (month)	8.8	2.26	4	12	25.7
Third	Lactation daily milk yield (liter)	2.2	0.69	0.5	3.8	31.9
	Lactation milk yield (liter)	569.0	246.34	144	1260	43.3
	Lactation length (month)	8.53	2.25	3.7	12	26.3
Overall	Lactation daily milk yield (liter)	1.8	0.54	0.5	3.3	30.1
	Lactation milk yield (liter)	463.1	189.72	108	1070	40.9

bulls (Takele, 2005) and mean age at castration of Kereyu male animals was 5.4 year that is almost similar to the reported value (5.7) for Sheko male animals.

Milk production and lactation performance of Kereyu cattle

The mean reported first, second and third parity daily and lactation milk yield of Kereyu cattle (Table 4) were 1.4 and 329 L; 1.9 and 491 L and 2.2 and 569 L, respectively, with the overall mean daily and lactation milk yield of 1.8 and 463 L, respectively. The reported (1.8 liters) mean daily milk yield for Kereyu cattle was higher than the recent report from extensive livestock breed survey done in Oromia Regional State with overall average daily milk yield of 1.4 L (Workneh and Rowlands, 2004) and the earlier report (CSA, 1995) for the national overall average of 1.17 L per day. Dereje (2005) reported similar on-farm daily milk yield of 1.8 and 1.9 L per day for Raya Sanga and Wello highland zebu cattle, respectively. However, this average value was slightly lower than the reported figure (2.3 L) for Sheko breed (Takele, 2005).

The mean reported first, second and third lactation lengths for Kereyu cattle were 8.2, 8.6 and 8.8 months, respectively, with the overall mean lactation length of 8.53 months. Dereje (2005) reported similar mean lactation length for Wello highland zebu cattle (8.6 months) and longer lactation length for Raya Sanga cattle (11 months). Zewdu (2004) reported mean lactation length of 8.7 months for Fogera cattle for the second parity, which was similar to the present report for Kereyu cattle for similar parity. The mean on-farm first and second lactation length reported by Zewdu (2004) for Semien and Wegera cattle breeds were 4.6 and 7.5 months, respectively that were shorter than the present finding for Kereyu cattle.

In general, however, the present result of lactation length of Kereyu cattle was longer than the earlier report for national average of 6.33 months (CSA, 1995). Lactation length has a genetic basis and is a major limiting factor of milk production in the tropics (Rege et al., 2001). There was a gradually increasing trend in the reported mean daily and lactation milk yield from the first to the third parity. Tadele et al. (2005) reported a similar increasing trend for Simmental x Borana crossbred cows under on-farm conditions. Individual variations were observed both for reproductive and productive traits considered in this study. These types of variations provide a solid basis for genetic improvement through selection.

Measured third parity lactation milk yield from sample population

Even though, the time of data collection was during the long dry season, the overall mean measured third parity daily and lactation milk yield was 2 and 543 L, respectively, as indicated in Table 5. This result was based on a single day, morning and evening, milk yield measurements from each lactation stage to verify what had been reported by the respondents through questionnaire. Accordingly, the result of the measured milk yield was similar to what had been reported by the respondents. This indicates the soundness of information generated from the respondents through questionnaire. High variation both in daily and lactation milk yield was observed (Table 5) as in the case of the reported one indicating the possibility of improving the performance of Kereyu cattle type through selection from within the existing breed.

Conclusions and recommendations

Kereyu cattle breed has both regional and national importance. They are kept for multipurpose functions. It has been practically observed during the study period that Kereyu people, who maintain the breed, mostly rely on milk production for their diet. The observed productive and reproductive performance of Kereyu cattle type is satisfactory under the prevailing stressful and very challenging environment, where the ability to survive under

Table 5. Measured third parity daily and lactation milk yield from sample population.

Variable	N*	Mean (L)	SD	Min	Max	CV (%)
Early daily milk yield (1-3 month)	18	2.6	0.86	1.2	3.8	33.2
Mid daily milk yield (4- 6 month)	18	2.1	0.82	1.2	4	39.8
Late daily milk yield (7-9 month)	18	1.4	0.79	0.5	3.5	55.9
Overall daily milk yield	54	2.0	0.41	1.2	2.6	20.1
Lactation milk yield		543	109.14	324	702	20.1

* N = Number of milking cows per lactation stage.

natural calamities (drought, climatic extremes, feed and water shortage) is necessarily more important than high production. The observed variations in quantitative traits among the sample populations in both sexes coupled with their adaptive traits, which they acquired through generations, would indeed justify the need for designing breed improvement programme for Kereyu Sanga cattle. Such a plan can fully exploit their genetic potential and thereby enhance their contribution in improving the nutritional status of the cattle owners and improving their role towards attaining the national development goals.

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