

Report

Multiplication and Distribution of Qorti' Borana Heifers to Enhance the Production and Genetic Quality in Urban and Peri-Urban Communities of Borana Zone, Southern Oromia: On-Station

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Abstract

The Borana cattle breed is valued for its milk and meat production, hardiness in arid climates, and cultural importance among the Oromo Borana people. Its adaptability and productivity make it one of the most important indigenous cattle breeds in Africa, and a strong foundation for genetic improvement programs. This report presents the outcomes of a Borana heifer multiplication and distribution to the selected FSRP district program in the pastoralist areas of the Borana Zone, Oromia Region. The program aims to enhance milk production, genetic quality, and household income through targeted breeding, community-level multiplication centers, and structured distribution following a pass-on or technology distribution based on charging system of Borana heifer. As a result, 29 heifers were managed to be produced in on-station Yabello Pastoral and Dryland Agriculture Research Center (YPDARC) during 2023 and 2024 breeding seasons and consequently, distributed to 8 households among which 2 were women in the first phase of distribution with health protocols followed national veterinary guidelines, including CBPP and FMD vaccinations. Results show that improved productivity, economic empowerment (especially for women), and growing community resilience in response to drought and livestock loss. The current market value of heifers in the zone was 45,000 ETB and sold milk 140 ETB/Lt. Therefore, The intervention was supported by Food Systems Resilience Programme (FSRP) for Eastern and Southern Africa, Oromia Agricultural Research Institute, IQQO to mitigate the current dairy product market crisis and animal genetic problems from September 2024 through July 2025 in the first phase.

Keywords

Heifer, Qorti', Multiplication, Distribution, Pastoralist

1. Introduction

East African Countries [Ethiopia] holds large potential for dairy development, mainly due to its suitable [3] and its large cattle population, which comprises 59.5 million [6]. Even though

there is a large dairy cattle population and favorable climatic conditions, self-sufficiency in milk production is low. Accordingly, they contribute an average of 1.37 liters of milk yield per

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Received: 22 August 2025; **Accepted:** 23 September 2025; **Published:** 14 November 2025



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cow per day and annually about 3.1 billion liters [23, 18]. Cattle are the main source of milk production, and they provide a significant contribution to family nutrition and money generation; however, goat and camel milk are also used in pastoralist areas of the country [18, 21]. With strong global expansion resulting from the increasing number of customers in developing nations, the dairy industry and market have altered dramatically [15]. Milk is generally referred to as a full nutritious diet because it contains 87.2 percent water, 3.7 percent lipids, 3.5 percent protein, 4.9 percent lactose, and 0.7 percent ash. It is a valuable source of protein, fat, carbohydrates, vitamins, and minerals required by humans, especially young ones, for growth and development. However, the milk consumption rate in Oromia (Ethiopia) is low, at 19 lt/capital [2] compared to other countries with 50 and 90 lt/capital rates in Uganda and Kenya [21]. According to [14, 10], there is no well-organized milk marketing system in Oromia [Ethiopia]. Considering the important prospects for smallholder income generation and employment opportunities from high-value dairy, dairy production in the tropics is mostly subsistence, with poor output and productivity, reliance on local breeds, and management characterized by extensive grazing and unregulated breeding. Indigenous breeds supply the majority of the milk in these systems, with local breeds accounting for nearly all of the milk produced in Oromia [7]. The demand for milk and milk products is increasing in developing countries, and the drivers of change in the dairy sector are demography, growing economies, underserved markets, conducive policy and an enabling environment, globalization, and market opportunities [26]. Dairy production has the highest potential to sustainably contribute to the Sustainable Development Goals (SDGs) due to its extended value chain. However, there is a need for periodic assessments of providing up-to-date information by policymakers [30].

To support the dairy sector, different interventions have been made by the government, development partners, national and international research institutions, and non-governmental organizations [28]. However, the sector has yet to fully realize its potential to produce enough milk and dairy products to meet domestic demand. As a result, the country is forced to import powdered milk and other milk products [13]. The development of the dairy sector can contribute immensely to poverty alleviation and improved nutrition in the country [1].

To meet the ever-increasing demand for milk, and milk products and thus contribute to economic growth, genetic improvement of the indigenous cattle has been proposed as one of the options. Genetic improvement of the indigenous cattle, basically focusing on crossbreeding, has been practised for the last five decades but with little success. Selection as an improvement tool has been given less emphasis [16]. There are basically common cattle breed raised in Ethiopia. Borana, a popular cattle breed, is predominantly utilized and widely distributed across various countries of Africa [9]. They belong to the group of Zebu cattle (*Bos indicus*), with their characteristic hump and pendulous dewlap. These breed originally descended from the first introduction of zebu into Africa from

West Asia. Zebu cattle are known to be better than the humpless cattle in regulating body temperature; hence with lower body water requirements. The Large East African Zebu cattle breeds, like the present-day Borana of Ethiopia, Kenya and Somalia, and the Butana and Kenana of the Sudan have very similar morphological characteristics to that of the zebu breeds of Asia [22]. The Oromo Borana cattle breed is well adapted to semi-arid tropical conditions. The breed has a high degree of heat tolerance, is tolerant to many of the diseases prevailing in the tropics and has the ability to survive long periods of feed and water shortage [16].

The Borana Zone is a semi-arid pastoralist area highly dependent on its indigenous cattle for milk and income [20]. However, productivity remains low due to inbreeding, poor feed, and drought. The Borana cattle breed, though resilient, produces milk only 1.5-2.5 liters/day under traditional management [11]. Therefore, the current intervention is supported by the Food Systems Resilience Programme (FSRP) for Eastern and Southern Africa, Oromia Agricultural Research Institute, IQQO, with the objectives of Qorti' Borana heifer multiplication and redistribution to increase access to productive animals (Qorti or improved heifer) and improve livelihoods [17].

2. Methodology

2.1. Site Selection

Three peri-urban Villages from district of Yabello (Did-Yabello, Dololo Hoola and Darrito) were selected based on water availability, grazing access, and community readiness and potential of their agro-ecology. Local agricultural development agents, local leaders, and cattle owners were also interviewed informally to incorporate local knowledge about cattle breeds in order to validate the information on the selection sites.

To support the data gathered through individuals, elders, village leaders, and socially respected pastoralists who were thought to have greater understanding of the current and previous social and economic situation of the target areas were contacted. Information on the current state and main restraints facing the Borana cattle productivity, breeding, indigenous knowledge on the management of breeding, major constraints, and alternative approaches to solving these issues were gathered before site selection.

Borana Zone is a vast and vibrant prominent zone one of the 21st in the Oromia region, and is located 564 km southwest of the capital city Addis Ababa. The area lies with altitudes ranging from 400-3,056 meters (m) above sea level with an average 1,500m. The district is characterized by an arid-semi-arid climate and receives an annual rainfall of 400 - 800 mm with an average of 919 mm [50]. In general, the main rainy season occurs between mid-June and September, followed by a dry season that might be intercepted by the short rainy season in February and March. The mean annual temperature ranges from about 8 °C to 28 °C throughout the year.

There are 17 urban kebeles, concentrated in major towns like Yabello. Borena is renowned for its pastoralist communities, whose livelihoods revolve around herding cattle, sheep, goats, and camels. Livestock estimates placed the zone's cattle population at over 5 million, sheep and goats at around 4 million each, and camels at approximately 200,000 [6].

2.2. Heifer Source & Selection

Heifers were selected from within high-performing Borana cows of the station, Yabello Pastoral and Dryland Agriculture Research Center (YPDARC), using phenotypic screening and dam milk performance (>2.5 L/day). Selection criteria was considered age (1-4 parity), reproductive health (disease free), and body condition score 2.5-3.5 [19] following documented dam record. YAPDARC was undertaking Borana cattle improvement project under Rangeland condition for the last over Eleven years and were the foundation of the current heifer multiplied and distributed. In this regard, good performing 64 selected dam were selected from on-station and managed to calving 44 calves and 29 heifers.

2.3. Breeding and Health Management

Multiplication centers used selected Borana bulls for the service. The multiplication and center development team implemented the current project. Artificial Insemination (AI) was not widely used due to infrastructure limitations, though future pilots are planned which was in line with the report [12]. Health protocols followed national veterinary guidelines, including CBPP and FMD vaccinations [24]. The feeding was Managed natural pasture grazing with supplementary hay and

limited concentration and mineral salt. Heifers were sheltered at their pre wean and drainage to ensure animal comfort and hygiene. A separate facility for heifers and calves was provided to prevent disease transmission and facilitate better calf growth.

3. Heifer Multiplication Phase

44 calves and 29 heifers were managed to be produced or born within the two consecutive breeding seasons using 64 dams under the station Yabello Pastoral and Dryland Agriculture Research Center (YPDARC) in a breeding seasons 2023-2024, by center multiplication groups with veterinary follow up. The secondary data on the indigenous Borana Heifers (Table 1), are reached first heat at ~22 months (~ 155 kg) and calved for the first time at ~41.8 months [44]. The typical calving interval averaged 442 days (~14.6 months), while daily milk yield ranged from ~0.3 L in dry season up to ~3.2 L/day under research management [32]. Similarly, Borana Heifer calved at an average of 34 months, with an 89% calf survival rate under traditional management [31] were used as guideline for the current multiplication and distribution purpose. Therefore, the first phase multiplied eight (8) improved (Qorti' in local language) heifers in line with previous reports an average age of (24 months), BSC (3.44), and MBW (230.75kg) and distributed to the target communities after attaining the minimal age for calving following Community Animal Health Workers (CAHWs) carried out reproductive monitoring and disease surveillance [17] in the first breeding season.

Table 1. The summary reproductive and milk yield performance of Borana heifers.

Trait	Estimate (Mean ± SD)	Source
Age at First Heat (puberty onset)	~22 months (~155 kg at puberty)	Abernossa data on puberty age and weight (PLOS, agrilri.org)
Age at First Calving	≈ 41.8 months (≈3.5 years)	Haile-Mariam & Kassa-Mersha, Ethiopia study
Calving Interval	≈ 442 days (≈ 14.6 months)	Same study, naturally bred Boran cows
Daily Milk Yield (Research Conditions)	≈ 3.2 L/day	Abernossa improved Boran performance
Daily Milk Yield (Pastoral management)	~0.30 L/day (dry season), 1.50 L/day (wet season)	Field study under pastoralist conditions

4. Distribution Phase

Calving first-lactation cows at 22 to 24 months of age with an optimal body weight is most favorable for decreasing feed costs for heifer rearing and increasing productive life [25].

Calving at this age requires adequate growth rates to attain target weights at breeding and calving. The desired weights at breeding, precalving, and postcalving are 55%, 94%, and 85% of mature body weight (MBW), respectively, to maximize future milk yield [29]. Desired growth rate thus depends on the desired age at calving and estimated body weight at

calving (94% of MBW) to calculate the number of days for growth and the total weight gain before calving. Typical recommended body weight gain from birth to calving (included conceptus gain) is 0.7 to 0.8 per day for Borana heifers with a breed average MBW of 300 to 380 kg and a calving age of 24 months or 730 days with birth weight at 25 to 28kg. The calculation to derive the weight gain needed from birth to precalving is following [8].

$$((300 \text{ kg MBW} \times 0.94) - 28 \text{ kg birth weight}) / 730 \text{ days} = 0.35 \text{ kg gain per day}$$

After weaning, heifer development continues with high rates of protein/muscle weight gain and low rates of adipose gain desired. During this period, heifers can be fed to gain 0.9 kg/d to reduce days until breeding, and thus calving, compared with lower rates of daily weight gain. Depending on the projects goal, heifer body weight at breeding should be 55% of MBW. Since, the weaning weight, breeding weight, and age at breeding of Borana heifer known, the growth rate from weaning to breeding could be calculated for the pastoralist and were distributed. In the previous report, from about 3 to 9 months of age, mammary development occurs at a faster rate than in other organs (allometric growth) and can be affected by nutrition during this period. When fed excess energy, epithelial tissue cell proliferation was decreased and additional adipose tissue was deposited in the mammary gland, which was associated with reduced later milk production [27].

4.1. Beneficiary Selection

Community selection committees identified 8 vulnerable households, prioritizing women-headed families, enterprises and model pastoralist. Beneficiaries (Male: 6; Female: 2) were received one day of training on animal care, housing,

culling, breeding, feeding, record keeping and other major husbandry practices [17]. The selection Criteria used to identify the pastoralist (Household) were based on:

- 1. Community readiness or willingness of the pastorals
- 2. Water availability and grazing access (agro-pastoral)
- 3. Previous Experience in Animal management in handling milk and selling
- 4. The number of their family size, preferably larger family was prioritized for the current give.

4.2. Transfer & Support

Each heifer was distributed at 12-14 months of age, preferably pregnant. Recipients signed a pass-on agreement to give the first female calf to a new household, a principle derived from Heifer’s "Passing on the Gift" model [17]. However, due to the specific goal of the project under the Oromia Agricultural Research Institute, each receiver were supposed to be pay the discounted current market value of heifer, 30,000-45,000 ETB to get one improved Qorti’ heifer from multiplication center, Yabello Pastoral and Dryland Agriculture Research Center (YPDARC).

5. Results and Impact

Table 2 and Table 3 depicts the outcome of heifers multiplied and distributed to the individuals selected by committee and number of heifer distributed, their live or mature body weight (MBW), body condition scoring (BCS), training participants, average milk increase and first distribution completion (a); Table 4. The feedback of pastoralists and impact of heifers as distribution occurred (b).

Table 2. Heifer Multiplied and Distributed.

Year / Season 23-2024				
Amount multiplied	Amount Distributed	Number of Beneficiaries (M)	Number of Beneficiaries (F)	Kebele Distribution
8	8	6		Darrito

8 Borana calves, which typically weigh an average of 25-28 kg at birth were produced at YPDARC station and distributed which was in line with the previous reports of [45] and [46] For target weight at first breeding, heifers should ideally reach 55-60% of their mature body weight at first breeding [47] before distributed. The mature Borana cows typically weigh between 380 kg and 450 kg, improved Borana can reach 400-550 kg [45, 5] and this translates to a target weight of approximately 209 kg to 270 kg for breeding purpose. Data

from previous report indicates an average weight at first estrus of Borana heifer was 216.4 kg and at first conception of 231 kg [5]. Therefore, target weight at first calving; Heifers should calve at 85-90% of their mature body weight [47]. This means a target weight of approximately 323 kg to 405 kg at first calving. To achieve these weight targets, a consistent average daily gain (ADG) was essential. A growth rate of Borana heifer 0.7 to 0.8 kg per day is generally recommended for heifers to reach first calving at around 24 months of age [47]. Under

optimal conditions, such as in a feedlot or with supplementation, Borana cattle can achieve higher daily gains (e.g., 1.3 kg/day in a feedlot or up to 1.16 kg/day with optimized diets [45, 48]. However, on pasture, an ADG of 0.7-1.0 kg/day is more typical [45]. Furthermore, studies have shown average daily gains for Borana calves ranging from 297-696 grams per day, depending on feeding conditions (e.g., pasture-only versus hay and concentrate supplementation [49, 48]. The overall body weight gain from birth to first calving for a Borana heifer typically ranges from approximately 300 kg to 380 kg. For example, a heifer calving at 325 kg after a 25 kg birth weight would have gained 300 kg (Table 1).



Figure 1. The Borana heifer breed and their multiplication.

Table 3. Number of Heifer distributed along with their live weight and Body condition scoring (BSC).

S/No.	Animal ID	MBW (Kg)	BCS
1	CH15/23	223	3.5
2	CH006/23	217	3.5
3	CH14/23	228	4.5
4	CH12/24	225	3.5
5	CH001/23	219	2.5
6	CH16/23	234	3.5
7	CH037/23	300	3.0
8	CH002/23	280	3.5

Table 4. The Pastoralist 'feedback on the impact of distributed heifer.

Indicator	2026-2026/27 Value
Heifers distributed	8
Average milk yield increase	1.8 → 3.5 Lt/day
Calves born	3
Training participants	15
Cost of 1 Heifer	30,000 ETB

Table 4 presented the impacts posed into their economy and livelihood through the distributed Qorti Borana Heifers in the first phase which implied Borana cows are also good milkers. The current results indicated that, it is in lined with previously milk yields reported under intensive and semi-intensive conditions. For instance, In kenya, muguga, improved Borana cows have produced 1130 kg milk over a 36 week period during which calves were suckled three times a day; at ngong, milk yield in the first four lactations of Borana cattle was reported as 866, 1088, 1084 and 912 kg with a respective lactation length of 213, 234, 220 and 199, and with butter fat percentage of 5.7, 5.8, 5.9 and 6.1, respectively [33], under more favourable production environment, in naivasha Borana breed cows produced up to 1657kg of milk per 252-day lactation [38]. On the other hand converting calf growth up to 7 month in to milk intake and adding recorded values of milk off-take for human consumption, lactation milk yield of Borana cows was calculated to be 843 kg under the pastoralist system in Ethiopia [39].

At Adami Tulu station (Ethiopia) average daily gain of the Borana was 696 g/day when fed hay and concentrate, 546 g/day when fed pasture and concentrate, and 385 g/day when maintained only on pasture. The respective figures for carcass weight were 266, 236 and 194 kg with dressing percentage of 57.2, 55 and 50.5. Superiority of the Borana dams over Ankole and other Zebu dams for growth characters of their calves has also been demonstrated.

6. Challenges and Production Constraints

Extended drought reduced natural forage
Access to veterinary drugs, and Vaccines was inconsistent in the district
Less access of credit Services

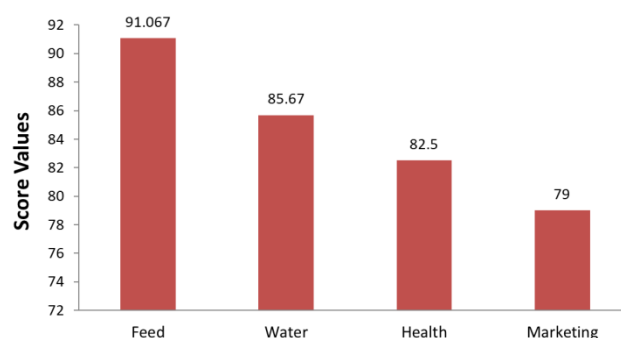


Figure 2. The potential production challenges in the current state of Borana Rangelands (2024).

Largely encroached rangelands posed significantly limited grazing areas, animal feed and water sources (Figure 1).

7. Conclusion

Borana cattle are very versatile, and adapt well to various or a harsh environments. The cows are very efficient converters of low quality pasture forage into body fat deposits, which are later, mobilized during periods of feed scarcity and lactation. The cows therefore hardly lose conditions during lactation or slight droughts. The breed has the ability to walk long distances even in the hot sun in search of water. The breed can withstand water stress and it is a common practice for the Borana herdsmen to water their cattle every 3 or 4 days [40]. Boran cows hardly experience calving difficulties, even when carrying crossbred calves, which are sired by larger breeds, such as Charolais [43, 42, 4]. Their crossbred progenies produce high quality carcass [34-37], hence, they are preferred by commercial ranchers in Kenya, and increasingly too, in other parts of the world as dam breed of choice in terminal beef cattle crossbreeding programs [41]. However, it has been shown that Borana cattle exhibit compensatory growth, which enables them to pick weight after losing it during the peak dry season and also Borana cows are also good milkers. Hereby, the improvement of the breed at their population level through selection, multiplication and preservation are currently undertaking in on-station, Yabello Pastoral and Dryland Agriculture Research Center (YPDARC).

8. Recommendations

The current Borana Heifer Multiplication and Distribution Program demonstrate the potential of community-based models to sustainably improve livestock productivity and income in arid zones. With further investment in feed, health services, and gender inclusion, the program can be scaled regionally. Therefore, the following major recommendations

can be forwarded as Borana heifer production, distribution, and maintenance and improvement strategies:

1. Expand hay banking and drought-tolerant forage adoption
2. Support CAHWs with mobile kits vet, drugs and trainings
3. Budget Limitation for heifers the infrastructure maintenance in Center for future use
4. Provide digging water wells, digging pond water as a source of drinking water during peak dry in selected FSRP districts in the zone.

Abbreviations

BCS	Body Condition Scoring
YPDARC	Yabello pastoral and Dryland Agriculture Research Center
MBW	Mature Body Weight
IQQO	Oromia Agricultural Research Institute

Acknowledgments

The current multiplication was funded by the Food Systems Resilience Programme (FSRP) for Eastern and Southern Africa, Oromia Agricultural Research Institute, IQQO with technical support from the YPDARC. In end, sincere appreciation goes to Dr. Girma Amante, for his well coordinating the project (FSRP) at the institute of OARI and completion of the current multiplication in the center.

Conflicts of Interest

The authors declare there is no potential conflict of interest among the Authors.

Appendix

Appendix I: Heifer Growth Chart Template (Growth Monitoring Sheet)

Table 5. Heifers Growth monitoring Template.

Heifer ID	Owner Name	Kebele	Date of Birth (Est.)	Weight (kg)	BCS	Age at 1st Heat	Date of Service	Calving Date (Expected)	Health Notes
		Dolollo Hoolaa		-	-	-	-	-	
		Diid yaballo	-	-		-	-	-	
		Darritoo	-	-		-	-	-	

Key: BCS = Body Condition Score (scale of 1 to 5);

All weights taken monthly using girth tape

CAHW (Community Animal Health Worker) responsible for monthly updates

Appendix II: "Pass-On the Gift" Agreement Template (Afaan Oromo + English)

Afaan Oromo:

Waliigaltee Dabarsa Horii

Maqaan nama fudhatee: _____

Naannoo/Kebele: _____

Guyyaa fudhatame: _____

Ani, maqaan kiyya armaan gadii tti ibsame, heeyyama guutuu haadha/buqqee jalqabaa horii sanyii Booranaa horii jalqabaa fudhadhe kana boodas Oomishaaf Oomishtummaa koo dabaluu akkasuumas deeggarsa barbaachisaa YPDARCn gara fuula duraatti hordoffii nabiratti taasifamuuf akkan gahee koo guutu/bahadhu nan waliigala.

Mallattoo _____

Guyyaa: _____

English:

Heifer Pass-On Agreement

Name of recipient: _____

Kebele/Woreda: _____

Date received: _____

I hereby notify the heifer I have received from the YPDARC station and agree to future monitoring and report conducted by the YPDARC within my community. This commitment is part of the community breeding and future redistribution system to help other vulnerable families benefit as I did or cooperate.

Signature: _____

Date: _____

Appendix III: Community Training Schedule for Beneficiaries

Table 6. Community Training Manual (Template) on the Heifers Distribution.

Day	Topic	Trainer	Tools/Materials	Location
Day 1	Heifer care & housing	Researcher, Animal breeder	Charts, Heifer housing model	YPDARC
Day 2	Feeding and grazing management	Ecologists, Range and Animal feed team	Sample feeds, pasture seeds	YPDARC
	Reproductive health & recordkeeping	DVMs and Vet Technicians in the center	Record book, demonstration cow	YPDARC
	Pass-on system & community ethics	YPDARC	pass-on document, group role-play	Community hall, YPDARC

Attendance was mandatory for all recipients.

Appendix IV: Reproduction and Health Logbook Template

Heifer Health & Reproduction Record (One per animal)

Owner's Name: _____

Heifer Tag No.: _____

Breed: Borana

Kebele: _____

Table 7. Heifers health Monitoring Template or sheet.

Date	Activity	Observation/Action	Personnel	Signature
	Deworming		CAHW	_____

Date	Activity	Observation/Action	Personnel	Signature
	Detected in heat		Owner	_____
	Natural mating		Bull keeper	_____
	Pregnancy check		Vet Technician	_____
	Calved (female)		Owner	_____

Appendix V: The YPDARC Dairy Farm Daily Record Sheets and Birth Weight Information

BED SITE :- Yabello Pastoral and Dryland Agriculture Research Center

Monthly date of inventory 30/05/2015

Table 1: Animal dynamics at the Farm site by quantities and animal category

No	Animal type	Ear tag	Date	Remark
1	Cow hawwichaa loonii	1000	10/07/16 2/05/2015	Dibichee #1 culled
2	Cow	129		
3	Cow	H 19	04/01/2016	Dhibichee dhalee
4	Cow	12	2/05/2015	culled
5	Cow	137	06/08/2016	06/08 faade dhalee
6	Cow	C 01	30/11/2015	gave birth to the calf
7	Cow	37	25/11/16	Dibichee
8	Cow	81	21/04/17	Dibichee stables
9	Cow	A 23	13/01/2016	Dibichee dhalee
10	Cow	C 05	2/05/2015	faade dhalee
11	Cow	A 24	06/05/2016	Dibichee dhalee
12	Cow	A 08		
13	Cow	A 20		
14	Cow	H 17	27/07/2015	It became ill and died
15	Cow	34		
16	Cow	H 40	07/03/2016	Dibichee dhalee
17	Cow	130	05/03/2016	Dhibichee dhalee
18	Cow	5		
19	Cow	55	28/07/2016	
20	Cow	36	06/04/2017	
21	Cow	A 09	03/01/2016	Dibichee dhalee
22	Cow	145		
23	Cow	126		
24	Cow	52		
25	Cow	A 37	2/05/2015	culled
26	Cow	140	05/08/2016	
27	Cow	124	02/10/2015	gave birth to the bull
28	Cow	C 19	2/05/2015	culled
29	Cow	C 09	12/12/2015	goromsa dhalee
30	Cow	A 22	2/05/2015	culled
31	Cow	A 05	2/05/2015	culled
32	Cow	136		
33	Cow	C 19	04/04/2016	Dibichee dhalee
34	Cow	15	20/06/2016	Raada dhalee
Total	34 - 1 = 33		01/04/2017	gave birth to the calf

34 14 63 5 5 15 49 63 5 5 129

Figure 3. On-station record keeping sheet.



Figure 4. Pictorial Qorti' Borana heifers distributed.

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