**RESEARCH ARTICLE**

# Begait cattle production systems and production performances in northern Ethiopia

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**Manuscript details:**

Received: 25.07.2017
Accepted: 13.10.2017
Published : 21.11.2017

**Cite this article as:**
Gebretnsae Mezgebe, Solomon Gizaw, Mengistu Urge and Arvind Chavhan (2017) Begait cattle production systems and production performances in northern Ethiopia; *International J. of Life Sciences*, 5 (4): 506-516.

**Acknowledgements**
The study was funded by Ethiopian Ministry of Education (EMOE) through Haramaya University (HU). The authors are grateful to EMOE and HU for giving this opportunity. We also acknowledge for Bgaite cattle farmers, people and institutes who directly or indirectly contributed for the accomplishment of this study.



**ABSTRACT**

The study was conducted to describe production systems and production performance of Begait cattle under small-scale and large-scale farms. Data were collected from 180 (120 small-scale and 60 large-scale) households through filed observation and direct interviews, and analyzed using descriptive statistics and analysis of variance. Households in both production scales considered income generation, calf production, and milk production as major purpose of keeping cattle. The mean analysis of variance of livestock holdings size were; 41, 31, 22, 9 and 2 for cattle, sheep, goats, chicken, and donkey, respectively. Except sexual maturity of breeding bull, production scale had significant ($P<0.05$) influence on other productive and reproductive traits. Large-scale farmers had significantly higher in daily milk yield and life calf born and also recorded shorter calving interval, age at first calving and dry period of cow than small-scale farmers. Though, there is difference on the level of impact, both large-scale and small-scale farms stressed by theft, water scarcity, seasonal feed shortage, and disease prevalence. From the current result, it is conclude that the observed herd size and milk production performance of Begait cattle is high compared to the indigenous cattle breeds in Ethiopia. Thus, the current breeding practices of Begait cattle farmers' need a designing appropriate selective breeding program to maintain this valuable genetic resource and improve their contribution to livelihoods of their keepers.

**Key words**: cattle, production system, trait preferences, breeding practices

## INTRODUCTION

Cattle are our most important livestock species because of their production and role in human culture (Felius et al., 2014). Indigenous cattle form the backbone of relevant and sustainable livestock production, due to their better adapted to survive and reproduce under the region's harsh environments (Okomo-Adhiambo, 2002). According to CSA (2015) report, 98.7% of the total cattle reared in Ethiopia had been indigenous cattle.

And they are contributing as nearly all the draught power of smallholder farmers; generate critical cash income, provide collateral for local informal credit and serve other socio-cultural functions in the country (Ulfina et al., 2005; Melaku, 2011). Despite the importance of indigenous cattle to the farming community in particular and to the national economy at large, the sector has remained underdeveloped.

Thus, to increase productivity of the indigenous cattle, crossbreeding with exotic breeds has been done through government and non-government organization for about six decades in the country (Chebo and Alemayehu, 2012). However, crossbreeding schemes resulted in limited improvement in productive traits and even less improvement in fitness traits (Azage *et al*., 2010; Kefena *et al*., 2011). This is apparently due to inadequate and/or coherent study on the indigenous knowledge of livestock producers, herd structure, keeping purpose and marketing, and factors affecting them may lead to incompatible improvement program and be hindering the potential's of indigenous cattle. Aynalem et al. (2011) expressed the insufficient and unreliable data and inadequate information as major obstacles for expansion and productivity improvements of indigenous cattle in the country.

Therefore, improvement in indigenous cattle can be achieved by thoroughly assessing: production system, performance of cattle, identification of production constraints, and then designing appropriate breeding strategies, which are compatible with the existing production system. Such information provides useful insights towards the designing and implementation of strategies to improve livelihood of smallholder farmers. However, this type of information is currently un-available or inadequate at best. Thus, the objective of the study was to describe production systems including production, input/service delivery and marketing practices and production performance of Begait cattle.

## MATERIALS AND METHODS

### *Study Area*

The survey was conducted in Kafta-Humera district, western zone of Tigray regional state. It is found between 13°42' to 14°28'N and longitude of 36°23' to 37°31'E, and at an elevation ranging from 530 to 1831 meter above sea level. The mean annual temperature varied from 25˚C to 41.7˚C and the mean annual rainfall also varied from 400mm to 650mm (NMAE, 2008).

Kafta-Humera district has 21 peasant associations (PAs) with different time of settlement and different agro-ecological zones. However, Begait cattle were found dominantly in lowland zone and early settled PAs. The cattle were herded collectively (80-120), which is locally known as "*Betri*" to share herding payment. However, Betri is currently functional in cattle herd formulated by many farmers while individuals can keep even ≥ 50 cattle for relatively higher management. Therefore, farmers consisting ≥50 cattle were considered as large-scale farmer and farmers consisting 1-49 cattle were considered as small-scale farmer throughout the paper.

### *Data collection*

The survey was conducted through filed observation and direct interviews in four purposively selected peasant associations (PAs) on their potentiality of Begait cattle population. 180 households (120 small-scale farmers 30 household from each PAs and 60 large-scale farmers 15 household from each PAs) were used to generate data on cattle herd sizes, keeping purposes, trait preferences, feeding management, breeding practices and selection criteria, health condition, service provision, and livestock production constraints. At the end, group discussions were held with informants in each PAs for greater insight into the topics covered during the structured interviews and to check whether patterns found in the household were validated by the focus group. Besides, secondary information was collected from development agent, district and zone bureau of agriculture.

### *Data Analysis*

The survey data was summarized and analyzed using descriptive statistics and variance analysis of SPSS (2011) and general linear model procedure of SAS (2008) software's. Paired t-tests were used to test the difference between group comparisons and differences among production means was tested using Duncan's Multiple Range Test. Purpose of cattle keeping, importance of principal traits and cattle production constraints were ranked by calculating index values using the principle of weighted average according to the following formula:

$$Index = \frac{R_n*C_1+R_n\text{-}1*C_2+\ldots+R_1*Cn/}{\sum R_n*C_1+R_n\text{-}1*C_2+\ldots+R_1*C_n}$$

Where: $R_n$= Value given for the least ranked level (example if the least rank is 5th rank, then $R_n$=5, Rn-1=4, and ..., $R_1$=1), $C_n$= Counts of the least ranked level (in the above example, the count of the 5th rank = $C_n$, and counts of the 1st rank = $C_1$).

Gross commercial off-take rate was calculated by using the following formula:

$$\text{Gross commercial off-take rate} = \frac{(sales\ )*100}{0.5(Opening\ Stock + Ending\ Stock)}$$

The denominator is the average stock, which is computed as a half of the sum of opening stock and ending stock over one year period. The gross commercial off-take involves animal sales and excludes other outgoings and incomings such as slaughters, transfers, exchanges, gifts and purchases.
By considering the number of breeding males (Nm) and breeding females (Nf), the effective population size (Ne) and rate of inbreeding (ΔF ) were also estimated using the equations of Ne =4 (Nm × Nf)/(Nm + Nf ) and ΔF = ½(Ne) , respectively (Falconer, 1989).

## RESULTS

### Household livestock production characteristics

#### *Background and characteristics of respondents*

Among the investigated households there is a significant difference between small-scale farmers and large-scale farmers of patterns. The former has 89% and 11% of male and female headed household respectively, but the latter was100% possessed on male ownership (Table 1). The overall mean land size was 9 hectares per household which may have a high potential for feed sources.

### Livestock Holding Size

The main activities of 88 and 93% interviewed households from large-scale and small-scale farmers are possessed on mixed crop livestock farming system. The remaining households were solely dependent on livestock keeping. Out of the total livestock owned, 39% were cattle, 30% sheep, 21% goats, 2% donkeys and 8% chickens. Not only cattle, livestock holdings of all types were higher in large-scale farms than small-scale farms (Table 2).

### Herd Characteristics

In both production scales, the proportion of adult female (76%) was higher than adult males (24%). At household level the proportion of breeding females was 39%, and the proportion of lactating and pregnant cows were almost similar which was significantly ($p<0.05$) higher in large-scale than small-scale farms (Table 3). When all female cattle considered, they constituted twofold of the herd. The corresponding figure for breeding males was 3%, and steers comprised the smallest proportion.

### Purposes of Keeping Begait Cattle

In both cases Begait cattle were kept primarily for income generation, producing stock replacement, and milk production. Income generation was ranked first by about 68% of large-scale and 57% of small-scale farmers (Table 4). The second important reason for keeping Begait cattle was calf production as stock replacement. The use of Begait cattle as a source of traction power was very low, and use of manure as fertilizer was not totally practiced.

#### *Cattle Management Practices*

### Feeding Management

Natural pasture was the most common feed resources used for all livestock species. Grazing land and crop-aftermath grazing were entirely communal. This type of grazing system gives a great opportunity for landless livestock producers to produce as land holding farmers. Farmers used only herded grazing practice all year-round due to the high fear of theft. Moreover, the conservation of forage sorghum, sorghum chaff, sorghum straw, and hay, was practiced in some extent while sesame residue is used informally in the cultivated area. These conserved feeds were used as supporting feed from February to May, especially for emaciated animals, cows get birth at dry season, lactating cows, old cows, and calves orderly. The rest groups of cattle were forced for grazing and browsing throughout the year.

Supplementing with commercial feeds was not totally practiced in the area; instead they use sorghum grain supplementation at the critical time (April to May) for especially selected animals. Using mineralized salt was common during rainy season and in diet changing.

**Table 1.** Cropland holding size, farming activities, and educational status of respondent

| Parameters | Small-scale N= 120 Frequency | Large-scale N=60 Frequency | Total N=180 Frequency |
|---|---|---|---|
| Cropland (hectare) | | | |
| 0 | 7 | 6 | 13 |
| 2 | 32 | 8 | 40 |
| 3 | 34 | 18 | 52 |
| 4 | 9 | 3 | 12 |
| 5 | 19 | 10 | 29 |
| 6-10 | 5 | 3 | 8 |
| >10 | 14 | 12 | 26 |
| Mean ± S.E | **6.65±1.36** | **14.35±5.51** | **9.22** |
| **Farming activity** | | | |
| Livestock only | 8 | 7 | 15 |
| Livestock and crop | 112 | 53 | 165 |
| **Ownership pattern** | | | |
| Women owners | 13 | 0 | 13 |
| Male owners | 107 | 60 | 167 |
| Family size mean ±S.E | **6.65±1.36** | **14.35±5.51** | **10.50** |

N= number of households; S.E= standard error of mean

**Table 2.** Overall species composition of herds

| Animal species | Small-scale farmers N= 120 | | | Large-scale farmers N=60 | | | Overall least square means |
|---|---|---|---|---|---|---|---|
| | Ownership households | No. of animals | Herd size/hh (mean ± SE) | Ownership households | No. of animals | Herd size/hh (mean ± SE) | |
| Cattle | 120 | 2272 | 18.9 ±1.27 | 60 | 5135 | 85.6±5.97 | 41.2 |
| Sheep | 81 | 3169 | 26.4 ±5.92 | 40 | 2437 | 40.6±8.57 | 31.1 |
| Goat | 53 | 2160 | 18.0±3.02 | 33 | 1820 | 30.3±7.02 | 22.1 |
| Donkey | 100 | 168 | 1.4±0.11 | 55 | 121 | 2.0±0.21 | 1.6 |
| Camel | 1 | 1 | 0.0±0.01 | 0 | 0 | 0 | 0.0 |
| Chicken | 90 | 976 | 8.1±1.01 | 43 | 572 | 9.5±1.97 | 8.6 |

N= number of households; hh=household; S.E= standard error of mean

**Table 3.** Herd structure of Begait cattle under large and small scale farmers

| Cattle Herd Structure | Small-scale N= 120 | | | Large-scale N= 60 | | |
|---|---|---|---|---|---|---|
| | N animals | Mean ± S.E | SL | N animals | Mean ± S.E | SL |
| **Total number of cattle** | **2272** | | | **5135** | | |
| Male calves <1year | 239 | 2.0±0.16 | *** | 529 | 8.8±0.72 | *** |
| Young bulls 1-3year | 243 | 2.0±0.17 | *** | 538 | 9.0±0.65 | *** |
| Adult male > 3year | 134 | 1.1±0.17 | *** | 417 | 7.0±0.64 | *** |
| Breeding bulls | 70 | 0.6±0.07 | *** | 126 | 2.1±0.18 | ns |
| Oxen | 25 | 0.2±0.07 | *** | 133 | 2.2±0.39 | *** |
| Female calves <1year | 269 | 2.2±0.17 | *** | 545 | 9.1±0.66 | *** |
| Young heifers 1-3year | 274 | 2.3±0.16 | *** | 578 | 9.6±0.79 | *** |
| Adult heifers > 3year | 201 | 1.7±0.18 | *** | 178 | 3.0±0.47 | ns |
| Lactating cows | 408 | 3.4±0.25 | *** | 1055 | 17.6±1.25 | *** |
| Pregnant cows | 344 | 2.9±0.25 | *** | 1005 | 16.8±1.28 | *** |
| Dry cows | 67 | 0.6±0.10 | ns | 31 | 0.6±0.16 | ** |
| Male to female ratio | 1:2.2 | | | 1:1.95 | | |
| Breeding bull to cow ratio | 1:11.7 | | | 1:16.60 | | |

N= number of household or animals; SL = significance level; S.E= standard error of mean

**Table 4.** Ranking the purpose of keeping Begait cattle as indicated by respondents

| | Small-scale N=120 | | | | | Large-scale N=60 | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Purpose | $R_1$ | $R_2$ | $R_3$ | $R_4$ | Index | $R_1$ | $R_2$ | $R_3$ | $R_4$ | Index |
| Income source | 56.7 | 40.8 | 5.0 | 0.0 | 0.3761 | 68.3 | 31.7 | 0.0 | 0.0 | 0.3886 |
| Calf Production | 38.3 | 36.7 | 22.5 | 0.0 | 0.3228 | 31.7 | 53.3 | 15.0 | 0.0 | 0.3321 |
| Milk for HC | 2.5 | 22.5 | 42.5 | 32.5 | 0.2042 | 0.0 | 15.0 | 61.7 | 8.33 | 0.1927 |
| Traction | 0.0 | 2.5 | 16.7 | 25 | 0.0690 | 0.0 | 0.0 | 25 | 31.7 | 0.0866 |
| Social values | 0.0 | 0.83 | 7.5 | 9.17 | 0.0279 | 0.0 | 0.0 | 5.0 | 28.3 | 0.0390 |

N= number of household; R= rank; HC= home consumption

**Table 5.** Household's response on Begait cattle breeding management

| | Small-scale N=120 | Large-scale N=60 |
|---|---|---|
| **Breeding management** | Number of household | Number of household |
| **Breeding system** | | |
| Pure breeding | 111 | 60 |
| Crossbreeding | 0 | 0 |
| Both pure and crossbreeding | 9 | 0 |
| **Mating system** | | |
| Natural mating with selected bull | 92 | 60 |
| Natural mating with unknown bull | 28 | 0 |
| **Sources of breeding bull** | | |
| Own herd | 53 | 60 |
| Neighbor's herd | 39 | 0 |
| Unknown (mating at field) | 28 | 0 |
| **Unselected bull controlling method** | | |
| Castration only | 0 | 0 |
| Selling only | 107 | 22 |
| Both castration and selling | 13 | 38 |

N= number of household

**Water Sources and Watering Frequency**

Rivers, bore wells, and pond water were the major sources of water for livestock in the area. In the dry season, most of cattle were depended on Governmental or private bore wells with 5-10ETB[1] payment per head per month. All respondents agreed that cattle trekked about 8 to 15km daily to rich the watering point as the feed availability becoming far from the residence and bore wells with the severity increases from February to May. Not only the distance of watering point, the time spent for keeping waiting list was reported as a major problem in cattle rearing.

**Cattle Housing**

In the study area, all farmers used open fenced barn that did not have roofing to shelter livestock. It is also changeable seasonally to meet their feeding habit of the animals. During the rainy season (June to September) cattle are simply fenced overnight near to communal grazing land, which is far to homestead and crop land. During the autumn (October to December) the housing system placed to the residence due to the availability of feed on crop-aftermath grazing around the homestead area. Then after the rest five months cattle spent without fenced barn, since the grazing time of cattle could be changed from day time to overnight to protect the enormously hot air condition. However, calves were left in the residence house with conserved feeds.

***Cattle Breeding Objectives***

**Initial Stock**

The sources of initial breeding stock were including purchases from the known neighbor farmers and nearby markets, gifts from parents and relatives. The attention of farmers in purchasing initial breeding stock focused on the breed type, production performance and production status.

(Pregnant or lactating) of the animal than its price. Due to this the purchasing among known farmers is

dominant, especially in highly Begait cattle populated areas. However, in areas of scattered Begait cattle production (new settler peasant association) lactating cow is preferable for purchasing as initial breeding stock by measuring its milk yield in that day.

The main types of local animals as observed and/or reported by key informants were Begait and Arado cattle in the district. It is important to note that the dominance of Begait cattle is increasing over the Arado cattle due to their relatively higher milk yield and meat production. Besides, keeping Begait bull is dominant in the new settler peasant association to change their initial stock (Arado) to Begait through crossbreeding as observed by the first author during the study period. Even though, the interest of new setter farmers on Begait cattle production is increasing, shortage of experience in identifying pure Begait bull and lack of information about its parental history was faced as a major problem in these farmers.

**Preferred Traits and Selection Criterion by Begait Cattle Farmers**

Farmers practiced selection of breeding animals based on their mental memory at early age. Breeding bulls that have relatively larger body size, aggressive, long body length, taller height at withers, thin neck and small head size were preferable next to milk yields of their dam.

Likewise, preferred traits of breeding cows were milk yield, body conformation, body size and calving interval, respectively (Table 5). Thus, selecting replacement stock were mostly done from their own flock; if not they should purchase from known neighbor herd. Most of the farmers were not preferable cows with black teat color, and long with gray teat color since it is considered as narrow teat cannel which is difficult for suckling and milking.

**Breeding Practice**

All of the large-scale farmers and most of small-scale farmers (92.5%) were used a pure breeding system but only 7.5% of the small-scale farmers were practiced both pure and cross breeding system (Table 6) between Begait and Arado through Begait Bull.

There was no report on controlled mating system. Bulls run with cows throughout the year. Random mating system is common in both small-scale and large-scale production systems. However, the estimated inbreeding rate was normal (0.19% in small-scale and 0.11% in large-scale farms) as compared to the recommendation of FAO (2012a).

***Begait Cattle Performance***

**Reproductive Performance of Begait Cattle**

Reproductive performance of Begait cattle is presented in Table 8. Except sexual maturity of breeding bull, production scale had significant ($P<0.05$) influence on other reproductive traits. Large-scale production level had recorded significantly shorter dry period, calving interval, and age at first calving than small-scale production level.

Large-scale farmers reported about 12, 23 and 37% of heifers for 27-29, 32-35, and 36-39months of age at first calving, respectively while small-scale farmers only 4 and 19% of heifers possessed in 29-35 and 36-39months of age, respectively. With regard to calving interval, only 8% of large-scale households possessed above the average estimated means of calving interval (13.9± 0.5 month), while 43% of small-scale households possessed above the average mean.

**Milk Production Performance of Begait Cattle**

Milking was practiced once a day after stimulating milk let-down made by calf suckling. However, newborn calves were suckling twice per day until one month with surplus milking practice. Then milking practice was continuing by leaving three, two, and one teats unmilked gradually. Besides, some farmers from the large-scale production were practiced milking without calf twice per day to provide enough milk for herdsman and full suckling opportunity for the rest calves by slaughtering her calf immediately before licking and keep some parts of the calf skin with addition of salt and oil in order to acclimatize milking without calf, which is locally known as "*Arem*". Milk yield from these types of cows were reported in the range of 12 to 15kg per day.

The mean analysis of variance of milk yield/cow/day was 5.5kg (Table 7). Production scale had significant ($P<0.05$) influence on milk yield. Large-scale farms were reported significantly higher daily milk yield than small scale farms. 70% of the large-scale farmers (40% 6-6.9kg, 20% 7-9kg, and 10% 10-12kg) produced more than the average milk yield/cow/day, while only 41% of small-scale farmers (27% 6-6.9kg, 10% 7-9kg, and 4% 10-12kg) produced more than the average milk yield/cow/day.

**Table 6.** Ranks of preferable traits by Begait cattle owners during selection and purchasing

| Trait preference | Male | | | | | Female | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | $R_1$ | $R_2$ | $R_3$ | $R_4$ | Index | $R_1$ | $R_2$ | $R_3$ | $R_4$ | Index |
| Body size | 47.5 | 41.7 | 10.8 | 0.0 | 0.337 | 15.0 | 11.7 | 33.3 | 30.0 | 0.192 |
| Body conformation | 27.5 | 25.8 | 46.7 | 0.0 | 0.281 | 18.3 | 20.0 | 26.7 | 36.7 | 0.223 |
| Milk yield (only for cow) | | | | | | 51.7 | 36.7 | 6.7 | 0.0 | 0.330 |
| Temperament (only for Bull) | 14.2 | 15.0 | 15.8 | 43.3 | 0.177 | | | | | |
| Trekking | 5.0 | 8.3 | 12.5 | 34.2 | 0.104 | 0.0 | 3.3 | 10.0 | 8.3 | 0.038 |
| Calving interval (only for cow) | | | | | | 8.3 | 11.7 | 15.0 | 18.3 | 0.117 |
| Coat color | 5.8 | 9.2 | 14.2 | 22.5 | 0.102 | 6.7 | 16.7 | 8.3 | 6.7 | 0.100 |
| **Sources of information as selection criteria for breeding bull** | | | | | | | | | | |
| Maternal performance | 90.8 | 10.8 | 0.0 | - | 0.421 | 81.7 | 18.3 | 0.0 | - | 0.512 |
| Sire performance | 9.17 | 52.5 | 20.8 | - | 0.341 | 13.3 | 51.7 | 13.3 | - | 0.285 |
| Sib performance | 0.0 | 12.5 | 29.2 | - | 0.172 | 5.0 | 13.3 | 70.0 | - | 0.203 |

R=rancks

**Table 7.** Productive and reproductive traits of Begait cattle

| Traits | Small-scale N=120 | | Large-scale N=60 | | SEM | p- value |
|---|---|---|---|---|---|---|
| | Mean | Range | Mean | Range | | |
| Milk yield (Liter/day) | | | | | | |
| -In feed availability | 5.04[b] | 2-10 | 6.33[a] | 2-12 | 0.1526 | <.0001 |
| -In feed scarcity | 2.29[a] | 1-3 | 2.41[a] | 1.5-3.5 | 0.0423 | 0.1941 |
| Lactation length (M) | 9.06[a] | 5-18 | 7.92[b] | 5-15 | 0.2229 | 0.0154 |
| Days open (M) | 5.83[a] | 1-15 | 3.03[b] | 1-9 | 0.2756 | <.0001 |
| Dry period (M) | 6.06[a] | 2-9 | 4.13[b] | 3-6 | 0.1225 | <.0001 |
| Calving interval (M) | 14.82[a] | 10-24 | 12.03[b] | 10-18 | 0.2756 | <.0001 |
| Age at 1st calving (M) | 44.47[a] | 29-60 | 37.62[b] | 27-48 | 0.4968 | <.0001 |
| Cow lifetime (year) | 14.38[a] | 10-20 | 11.85[b] | 9-18 | 0.1788 | <.0001 |
| Number of calf born/CLS | 10.71[b] | 7-15 | 11.40[a] | 7-15 | 0.1295 | 0.0110 |
| Male sexual maturity (M) | 39.13[a] | 18-54 | 38.75[a] | 18-54 | 0.5775 | 0.7487 |
| Bull lifetime (year) | 6.39[b] | 5-13 | 7.25[a] | 4-11 | 0.1852 | 0.0198 |

Means in a row with different subscripts are significant at $p<0.05$; M= month; N=number of household; SEM = standard error of mean

***Inputs/Services and Marketing***

**Animal and Animal Product Marketing in Kafta-Humera District**

The main reasons of farmers to sell animals are to pay labour for agricultural activities, repayment of credit and fear of theft. Selling of livestock during dry season due to shortage of feed is not a reason in the area; instead they are preferred to move animals from place to place within the district. Besides, selling of animals to buy food is not common due to the ample production of sorghum as food and for cattle supplementation in some extent.

The price of cattle is mostly focused on individual appearance and parental history. Regardless of the two production system, young bulls that have long body size, aggressive temperament, taller height at wither and mixed coat color with 6 to 9 milk yields of its mother fetch higher price. Generally, the number of selling animals and their price was depends on the production and price of sesame cash crop. This means farmer's sale their cattle if and only if they face money problem but do not have preferable time for sale. The time of selling were made more or less regularly throughout the year. However, the peak sale of cattle is during the months of June to finance agricultural labour and ploughing fee and December for loan repayment.

The gross commercial off-take rate (20 and 18%) and the sale of breeding cow proportion (11 and 8%) was significantly higher in large-scale than small-scale farmers. However, the proportion of young bull (82 and 71%) selling was significantly higher in small-scale than large-scale farms (Table 8).

**Table 8**. Number of Begaite cattle sold in 2013/4 under small-scale and large-scale farmers

| Group of cattle | Small-scale farmers | | | | Large-scale farmers | | | |
|---|---|---|---|---|---|---|---|---|
| | Mean± S.E | Mini | Maxi | Total | Mean± S.E | Mini | Maxi | Total |
| Young bull | 2.77±0.25 | 0 | 11 | 332 | 11.95±1.10 | 2 | 43 | 717 |
| Old bull | 0.19±0.04 | 0 | 2 | 23 | 0.95±0.15 | 0 | 4 | 57 |
| Oxen | 0.10±0.04 | 0 | 3 | 12 | 1.60±0.20 | 0 | 5 | 96 |
| Heifer | 0.04±0.02 | 0 | 1 | 5 | 0.48±0.14 | 0 | 6 | 29 |
| Breeding cow | 0.26±0.05 | 0 | 3 | 31 | 1.80±0.20 | 0 | 5 | 108 |

**S.E= standard error of mean; Mini= minimum; Maxi= maximum**

Table 9. Ranks of constraints in Begait cattle production

| Constraints | Small-scale: N=120 | | | | | Large- scale farmers: N=60 | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | $R_1$ | $R_2$ | $R_3$ | $R_4$ | Index | $R_1$ | $R_2$ | $R_3$ | $R_4$ | Index |
| Feed shortage | 35.8 | 32.5 | 17.5 | 0.0 | 0.2810 | 56.7 | 35 | 5 | 0.0 | 0.3417 |
| Theft | 63.3 | 22.5 | 12.5 | 0.0 | 0.3523 | 16.7 | 26.7 | 28.3 | 18.3 | 0.2217 |
| Disease | 0.0 | 25.8 | 34.2 | 42.5 | 0.1919 | 6.67 | 11.7 | 25 | 28.3 | 0.1400 |
| Water scarcity | 0.8 | 15.8 | 24.2 | 30.8 | 0.1324 | 20 | 13.3 | 21.7 | 33.3 | 0.1967 |
| Labor scarcity | 0.0 | 2.5 | 9.2 | 5.8 | 0.0323 | 0.0 | 11.7 | 18.3 | 16.7 | 0.0883 |
| Predator | 0.0 | 0.8 | 1.7 | 4.2 | 0.0102 | 0.0 | 1.67 | 1.67 | 3.3 | 0.0117 |

N=number of household; R= ranks

Regarding animal product marketing, about 62% and 53% of small-scale and large-scale farmers were sold their raw milk to local traders while 12% and 7% sold their whey or locally processed milk to neighbor households. The amount and price of milk depend on quantity and quality feed availability. In the season of succulent feed availability (July to December) milk production rich to the peak while the price of raw and processed milk decreased by 42% than the price of milk in the dry season.

The way of currency exchange was done totally traditional through per animal pricing and per volume of milk and milk products without quality priority.

**Extension services**

In the study area, the sources of agricultural service are only given by the wored offices of agriculture and rural development (OoARD). The OoARD extension package mostly focused in promoting the introduction of exotic breed through crossbreeding to increase milk production. However, farmers were neglecting this service due to their lack of survivality in the hot environment and slow trekking ability of crossbreed cattle for feed and water searching. Besides, the interest of owners is not to increase milk production while they are challenged by market problem of their milk production. Thus, the interest gap between OoARD and the producers may increase in hesitating of producers even in other important services. Thus, the extension system has to be re-oriented to respond to the increasing demand of market-oriented livestock development to benefit farmers themselves and contribute to the national economy.

**Veterinary services**

As the individual interview and focus group discussion report indicated that the major diseases were trypanosomiasis, pasturolosis, anthrax, blackleg, lumpy skin disease, swelling, mastitis, and foot and mouth disease, respectively. Trypanosomiasis and pasturolosis diseases that are locally known as *Silim* and *leshlesh* were treated by using Diminazen and Oxytetracycline, respectively by most of farmers. Moreover, provision of mineral salt and excluding cattle from dirking very cold water were considered as a prevention method of trypanosomiasis by cattle owners.

As with the extension service; veterinary services were also provided almost solely by the woreda OoARD, and often far below the demand by farmers. For example, in the district, where huge livestock are reared (Table 2) and livestock diseases were mentioned as the most important constraint (Table 9), only one clinic center for three to five peasant associations with two-three staff members were provide the veterinary services like other district of the reign, which are mainly 2-5 cattle holds. Due to this, most of the peasant's livestock got a veterinary service twice per month through mobile animal health technicians by omitting the emergency care.

Vaccination was rarely administered through the office of agricultural extension veterinarians, animal health assistant and animal health technician's, but donkeys were lucky for this service while cattle, sheep and goats were left from this service due to shortage of transportation and unwillingness of veterinary servant to provide the service at their communal grazing lands.

***Constraints to Begait cattle production***

Among the constraints theft, shrinkage of grazing land, diseases prevalence and water scarcity were considered as the most important problems ranked first, second, third and forth with different index values, respectively in small-scale farms (Table 9), while large-scale farms were ranked shrinkage of grazing land, water scarcity, theft and diseases prevalence as first, second, third and forth. Thus, the result indicated that large-scale farms give better attention than small-scale farms for controlling theft and disease prevalence because, small-scale farmers are used group herding system to minimize the payments of hired labour but this collection of herding system leads to lack of commitment in different activities of cattle production.

## DISCUSSION

***Herd Size and their Characters***

In Ethiopia, small herd size and low fecundity rate of cattle had been reported as main limiting factors of adequate and sustainable supply of quality live animals for meat processing (Asfaw and Jabbar, 2008; AGPLMD, 2013). Besides, the bulk of low quality cattle such as culled draught oxen had been dominant in the market (Berhanu, 2007; Asfaw and Jabbar, 2008), which can affect the efficient utilization of meat processing capacity. Consequently, participation of small-scale farmers and pastoral cattle producers had been limited in marketing with competitive prices of their cattle.

Although, there were differences across production systems, the current study were estimated relatively higher herd size (41), higher proportion of breeding cows to adult male's ratio (3.2:1) and relatively shorter CI (14months). Figures from this study also indicated that 74% of the sold cattle were young bulls (1-3years), which could be confirmed quality live of supply. Ameha (2011) stated that meat quality changes markedly with an animal's age or weight at slaughter. The difference may be due to the difference in keeping purpose, indigenous knowledge of farmers, herd size, fecundity rate and feeding management among the indigenous cattle of Ethiopia. According to Dereje et al. (2014), the proportion of the different classes of animals reflects the management decision of the producers which in turn is determined by the production objectives. In systems where the main utility function is supply of milk and meat such a large proportion of the adult female population is expected (Mwacharo and Rege, 2002). Moreover, off-take rates of cattle mainly depends on the keeping purpose of farmers (as productive assets or as income sources) (AGPLMD, 2013), herd size and reproductive rates (Lubungu et al., 2012), as herd size increases, household is more likely to be net seller than to be net buyer (Gebremedhin et al., 2015). Enkono et al. (2013) stated that a unit increase in cattle owned will increase participation of farmers in marketing; therefore, large herds generate a higher marketable surplus than small herds. Thus, the current study indicated that Begait cattle have a great potential to facilitate the shortage of supply in quantity and quality of live animals for domestic and export meat processing.

***Milk yield of Begait cattle***

The findings in the current study confirmed a great variation between production scales and within production scales that can initiate genetic improvements of indigenous cattle through selection. About 12% of the interviewed households reported 46-118% of daily milk yield increment from the estimated mean without any supplementation and with once milking time per day. Research studies have been reported decreased milk yield by 34% in once-daily milking than twice milking in the entire lactation period (Holmes et al., 1992; Rémond et al., 2004; Clark et al., 2006). However, once-daily milking had been significantly improved the postpartum reproductive performance of cattle without affecting the growth performance of their calves (Browning et al., 1994; Johari et al., 1995). Dickerson (1970) also suggested that the ability to reproduce is by far the most important contributor towards efficiency, and the ability to reproduce in a given feed environment is related to its mature size. Previous studies also recorded a wide variation like the current finding from other Ethiopian indigenous cattle; for instance, Zewdu et al. (2013) recorded 2 to 10kg range of daily milk yield and 1150kg lactation milk yield with a maximum of 1350kg from best 15% of Mahibere-Sellasie composite cattle without any supplementation. Elias et al. (2015) also recorded 34 and 53% lactation milk

yield increment from best 25% and best 10% of Sheko cattle, respectively.

The indicative performance of daily milk yield (12-15kg) from cows milked twice per day highlighted how productive potentials of the breed is hindering by production objectives, husbandry practice of farmers, shortage of market accessibilities, and lack of compatible breeding strategies. Thus, the current result indicated that Begait cattle have relatively higher milk producing potential than other indigenous cattle in Ethiopia, and can be more increased through selection, provision of market opportunity, and improving the management practice of farmers to contribute for the huge demands of milk and milk product in the country.

***Major Constraints***

In tropical countries, lack of feed supplementation during the dry season is frequent, especially in extensive or traditional management systems. This situation leads to a problem of seasonal weight loss of approximately 20–40% of the body weight at the onset of the dry season (Lamy et al., 2012). In Mixed-crop production systems the challenge is better to integrate the nutrient management of crop and animal production enterprises within the system, to be relatively self-sufficient and reduce dependence on external inputs (FAO, 2012b). However, shortage of awareness on feed conservation and feeding habit of farmers were made to increase severity of feed shortage in the study area while ample feed resources are available in wet season. Water sources were also reported to dry up during the dry season. Consequently, cattle were forced to goes long distance daily starting from 4:00 to 5:00 o'clock, which is the most preferable time for grazing to reach early on the watering point. Hence, long distance trekking of cattle for searching feed and water were resulted in seasonal milking practice of farmers. Therefore, training of farmers on feed conservation and expansion of water sources at communal grazing lands are required.

The supporting service, amount of drugs and veterinary equipment to address the health problem was mentioned to be minimal in the study area. Consequently, animal health activities were being done by farmers, though sometimes in the wrong way. This will have an impact on off-take rate of cattle and hence income of households and/or may increase economic importance of the disease due to high or low dosing rate. Hence, designing proper disease controlling strategies or trained the already started cattle keepers as animal health worker is crucial.

The impact of theft was also mentioned as a big challenge in different activities of Begait cattle production from time to time. Thus, some farmers were becoming hopeless in rearing this valuable breed and then sold their total cattle at a point of time. Besides, sale of breeding bull at young stage, increasing hired labour payment, limiting grazing area and water accessibility due to fear of their security are increasing. Therefore, if this bad action is continue, it may be destroyed the highly potential breed from their habitat or may be changed by other breed like Arado cattle due to relatively slow trekking ability, lower price, and then lower acceptance by the neighbor country participants/sellers. To overcome this action, the government should give attention on controlling informal/cross-boundary movements of cattle. Besides, strengthen of livestock marketing places through controlled taxing system may be contribute to identify the seller and buyer with their origin of the animal in anywhere.

## CONCLUSION AND RECOMMENDATIONS

Begait cattle were almost reared in mixed crop livestock production system mainly as sources of income. The awareness and practice of farmers in selecting breeding animals can initiate productivity and keeping purity of Begait cattle. However, the process of selling animals and animal products was totally traditional without quality priority. Though, there is difference on the level of impact, both large-scale and small-scale farms stressed by theft, water scarcity, seasonal feed shortage, and disease prevalence. Therefore, there is an urgent need that measures are taken on carful controlling of cross boundary cattle movement, expansion of water sources, improving feed conservation practice and veterinary services. Generally, the observed herd size and keeping purpose of farmers can have the potential to provide a regular supply of meat for export markets and milk production performance of Begait cattle is high compared to the local cattle breeds in Ethiopia. Thus, the current breeding practices of farmers' need a designing appropriate selective breeding program to maintain this valuable genetic resource and improve their contribution to livelihoods of their keepers.

**Conflicts of interest:** The authors stated that no conflicts of interest.

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