# Characterization of Indigenous Goat Breeding Practices and Production System in West Gojjam Zone, Amhara National Regional State, Ethiopia

Bekalu Muluneh[1]    Kefelegn Kebede[2]    Yoseph Mekasha[2]

1.Department of Animal and Range Science, Wolaita Sodo University, Dawuro Tarcha Campus, P.O.Box 138 Tarcha, Ethiopia

2.Department of Animal and Range Science, Haramaya University, Haramaya, Ethiopia P.O.Box 138, Dire Dawa, Ethiopia

**Abstract**

The study was carried out in Bahirdar Zuria, Yilmana Densa and Gonji Kolela districts of Western Gojjam zone of Amhara National Regional State. The objectives of the study were to characterize production system and environment and to identify trait preference, breeding practices and objectives in the study area. A total of 270 households were selected purposively for characterization of the production practices. Data were gathered through semi-structured questionnaire, focus group discussions and field observations. The result of the study showed that the major farming activities in the study area were mixed crop and livestock farming. Mating practice was natural mating or uncontrolled mating within the household's flock and between neighboring flocks. In Bahirdar Zuria district respondents were keeping goats primarily for wealth status, whereas the primary reason for goat owners in Yilmana Densa and Gonji Kolela districts were for meat consumption. In study area appearance, color, character and age were the main criteria's for selection of breeding bucks, whereas, twining ability, appearance, age at first sexual maturity and color were for does. When goat flock of a household were not mixed, inbreeding depression for goat in Bahirdar Zuria, Yilmana Densa and Gonji Kolela districts were 0.30, 0.19 and 0.22, respectively. Mixed crop and livestock rearing were the major farming activities in the study area and the goat producers were practicing uncontrolled mating. Further research is recommended to know more about traditional animal breeding practices.

**Keywords:** Appearance, breeding, characterization, inbreeding, mating

## 1. Introduction

Ethiopia is endowed with huge livestock resources of varied and diversified genetic pools with specific adaptations to a wide range of agro-ecologies. In developing countries, livestock production is mostly subsistence oriented and fulfills multiple functions that contribute more for food security (Roessler *et al.,* 2008; Duguma *et al.,* 2010). Goat can survive and reproduce in harsh environmental conditions and on poor quality fibrous feeds. They have a high reproductive performance and are drought resistant Peacock (1996). They have also socio-economic importance whereby they provide meat, milk, skin and fiber, as well as manure and serve as the sole or subsidiary livelihood for a large number of small and marginal farmers and landless laborers (Thiruvenkadan and Karunanithi, 2006**).** There are approximately 570 breeds and types of goats in the world, of which 89 are found in Africa Galal ( 2005). The goat population of Ethiopia ranks high both in Africa and the world. According to CSA (2012), the number of goats reported in the country is estimated to be about 22.6 million, of which about 70.6% are females and 29.4% are males. Knowledge of traditional animal breeding practices and techniques is important to develop sustainable genetic improvement schemes under smallholder situations. Lack of such knowledge leads to the setting up of unrealistic breeding goals in the design of livestock genetic improvement programs and the consequence of which can put in danger the conservation of indigenous animal genetic resources Zewdu *et al*. (2006). Although documentation of traditional animal breeding practices is very essential for genetic improvement, it is scanty in West Gojjam zone of Amhara National Regional State. This study, therefore, was carried to characterize the production system and production environment in the study area and to identify farmer's trait preferences, breeding practices and objectives.

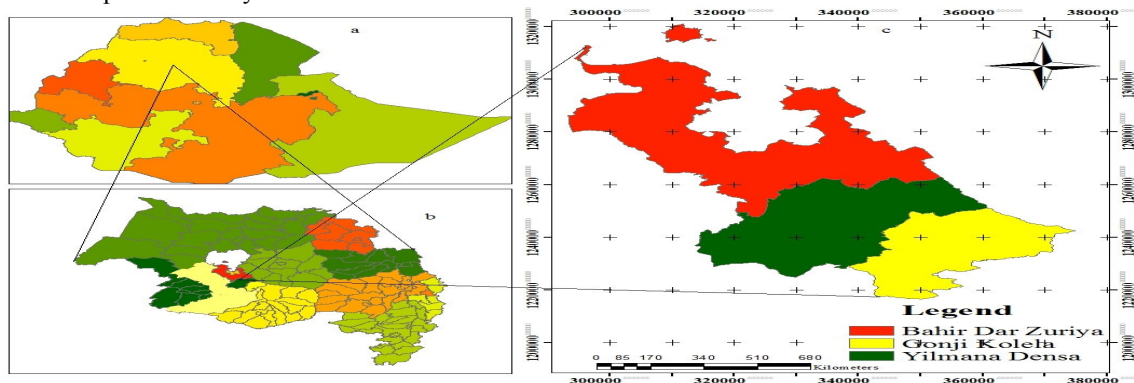## 2. Materials and Methods

### 2.1. Description of Study Area



Figure 1. Map of the study area (a: Ethiopia; b: Amhara National Regional State; c: study districts)

Bahir Dar Zuria woreda is bordered on the south by Yilmana Densa, on the southwest by Mecha, on the northwest by the Lesser Abay River, which separates it from Semien Achefer, on the north by Lake Tana, on the shores of Lake Tana situates the city and special zone of Bahir Dar, and on the east by the Abay River which separates it from the South Gondar Zone. Gonji Kolela was the second woreda selected for the study. It is bordered on the south by Bibugn woreda, on the East by Hulet Ejju Enese woreda, on the West by Yilmana Densa woreda and on the north by South Gondar Zone. Yilmana Densa was the third woreda considered for the study. It is bordered on the south by Kuarit, on the southwest by Sekela, on the west by Mecha, on the north by Bahir Dar Zuria, on the east by the Abay River and on the southeast by the East Gojjam Zone.  The study areas situated at an elevation of between 1700 and 2200 masl. The average annual temperature and rainfall of the districts were range between $18^0C$-$21^0C$ and 1000-1150mm, respectively.

### 2.2. Sampling Procedure

A multi-stage purposive sampling technique was employed for the selection of districts and peasant associations for the study. In the first stage, districts known for goat populations were identified and followed by identification of potential peasant association and villages. Potentials for goat production and road accessibility were used as criteria in selecting the sites. Thus, three districts were purposively selected based on goat population potential and road accessibility. From each districts three peasant associations (PA) were selected purposively based on the same criteria. A total of 270 households (goat owners) (30 from each PA and 90 from each district) were strategically selected based on possession of goats for interview.

### 2.3. Data Collection

Questionnaire was designed to address the description of the socio-economic practices of the community, description of the production environment and goat husbandry practices. Information on socio-economic practices of each household family and their major sources of income were collected. The main agricultural production by the local community besides livestock rearing was surveyed. The type of crop produced and type of livestock reared by the community in the study area including their number were assessed using questioner and by gathering secondary information. Information on major breeding practices were collected from each selected household through utilizing designed questionnaire, focus group discussion and group discussion (with extension workers and model farmer's).

### 2.4. Data Management and Analysis

Data collected through questionnaire were described by statistical analysis system SAS version 9.2 (2008). Chi-square test was employed when required to test equal probability assumptions. Statistical significance for quantitative data was done using F test. Indices were calculated to provide ranking of the reasons of keeping goat, trait preferences, livestock species preference, selection criteria, importance of major farming activities and major constraints of goat production according to the following formula: Index = $\Sigma$ of [3 for rank 1 + 2 for rank 2 + 1 for rank 3] given for particular qualitative variables divided by $\Sigma$ of [3 for rank 1 + 2 for rank 2 + 1 for rank 3] for all qualitative variables considered. Effective population size for randomly mated population was calculated according to (Falconer and Mackay, 1996) as: Ne = (4Nm* Nf) / (Nm + Nf) Where, Ne = effective population size, Nm = number of breeding males and Nf =number of breeding females. The rate of inbreeding coefficient ($\Delta$F) was calculated from Ne as $\Delta$F = 1/2Ne.

## 3. Results and Discussion

### 3.1. General Household Information

The majority (92.9%) of the households in the study area were male headed while the remaining proportion was headed by females (Table 1). Similar to this study, Tesfaye (2009) noticed in Metema woreda that among the household heads, 97 % were male headed while only 3 % were female headed.  In the study area the sampled households have different educational background. The majority of them (51.85%) were illiterate and 41.85% were able to read and write while the remaining proportions of households have attended primary school. In spite of this the proportion of illiterate in this study was lower than the reports of Dire Dawa 79.4%; Grum (2010). According to respondents in this study, the overall proportions of married, divorced and widowed households were 87.41%, 7.4% and 5.19%, respectively (Table 1).

Table 1. Household information in the three study districts of West Gojjam Zone

| Variables | District | | | | | | Overall | |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| | Bahirdar Zuria | | Yilmana Densa | | Gonji Kolela | | | |
| | N | % | N | % | N | % | N | % |
| Sex structure | | | | | | | | |
| • Male | 85 | 94.44 | 85 | 94.44 | 81 | 90 | 251 | 92.96 |
| • Female | 5 | 5.56 | 5 | 5.56 | 9 | 10 | 19 | 7.04 |
| Age structure | | | | | | | | |
| • <31 | 8 | 8.89 | 14 | 15.55 | 10 | 11.11 | 32 | 11.85 |
| • 31-40 | 28 | 31.11 | 20 | 22.22 | 39 | 43.33 | 87 | 32.22 |
| • 41-50 | 30 | 33.33 | 33 | 36.67 | 29 | 32.22 | 92 | 34.07 |
| • 51-60 | 18 | 20 | 15 | 16.67 | 11 | 12.22 | 44 | 16.3 |
| • >60 | 6 | 6.67 | 8 | 8.89 | 1 | 1.11 | 15 | 5.56 |
| Marital status | | | | | | | | |
| • Married | 84 | 93.34 | 80 | 88.88 | 72 | 80 | 236 | 87.41 |
| • Divorced | 4 | 4.44 | 5 | 5.56 | 11 | 12.22 | 20 | 7.4 |
| • Widowed | 2 | 2.22 | 5 | 5.56 | 7 | 7.78 | 14 | 5.19 |
| Educational status | | | | | | | | |
| • Illiterate | 50 | 55.56 | 47 | 52.22 | 43 | 47.78 | 140 | 51.85 |
| • Read and write | 34 | 37.78 | 36 | 40 | 43 | 47.78 | 113 | 41.85 |
| • Primary | 6 | 6.67 | 7 | 7.78 | 4 | 4.44 | 17 | 6.3 |

N=Number of households

### 3.2. Composition of the Livestock Species

The major livestock species in the study area were goat, sheep, cattle, chicken, donkey, horse and mule (Table 2). The number of goats is higher than all livestock species recorded per household in the study area and the main reason behind this is that the trend of goat rearing was increasing due to their significance as they can tolerate feed shortage than other livestock. Similarly, Tesfaye (2009) indicated that goat number per household in Metema woreda is higher than other livestock species.

Table 2. Livestock holdings per households in the study area

| Livestock | Bahirdar Zuria | Yilmanadensa | Gonji Kolela | Overall |
| --- | --- | --- | --- | --- |
| | Mean±SD | Mean±SD | Mean±SD | Mean±SD |
| Goat | 10.4±4.47 | 11.9±5.86 | 14.4±6.66 | 12.24±5.94 |
| Cattle | 6.02 ± 3.62 | 5.84 ± 3.64 | 4.4 ± 1.72 | 5.4±3.2 |
| Sheep | 1.55±2.81 | 1.98±3.17 | 3.33±3.23 | 2.29±3.16 |
| Chicken | 6.18±0.43 | 6.31±3.87 | 6.7±3.63 | 6.4±3.87 |
| Donkey | 1.12±0.92 | 1.01±0.85 | 0.98±0.74 | 1.03±0.84 |
| Mule | 0.02±0.15 | 0.01±0.1 | 0.07±0.27 | 0.03±0.19 |
| Horse | 0.02±0.15 | 0.02±0.15 | 0.02±0.15 | 0.02±0.14 |

SD=Standard Deviation

### 3.3. Major Farming Activities

The overall major farming activities in the study area were mixed crop and livestock farming, since the area is suitable for both rearing of livestock and cultivating crop coupled with conducive climate for agriculture. The majority of the farmers in the study area depend on growing teff, sorghum, maize, wheat, barley, faba bean, pea, soyabean, pea grass, haricot bean, and chickpea as major source of cash income and household consumption.

Table 3. Major crops grown in the study area

| Major crops | District | | | | | | Overall | |
|---|---|---|---|---|---|---|---|---|
| | Bahirdar Zuria | | Yilmana Densa | | Gonji Kolela | | | |
| | N | % | N | % | N | % | N | % |
| Barley | 36 | 40 | 31 | 34.4 | 24 | 26.67 | 91 | 33.7 |
| Wheat | 44 | 48.89 | 43 | 47.8 | 33 | 36.67 | 120 | 44.44 |
| Teff | 89 | 98.9 | 90 | 100 | 90 | 100 | 269 | 99.6 |
| Sorghum | 68 | 75.56 | 63 | 70 | 64 | 71.1 | 195 | 72.22 |
| Maize | 79 | 87.78 | 74 | 82.22 | 80 | 88.89 | 233 | 86.3 |
| Faba bean | 39 | 43.33 | 41 | 45.56 | 45 | 50 | 125 | 46.3 |
| Pea | 30 | 33.33 | 26 | 28.89 | 40 | 44.44 | 96 | 35.56 |
| Chickpea | 65 | 72.22 | 60 | 66.67 | 69 | 76.67 | 194 | 71.85 |
| Haricot bean | 32 | 35.6 | 29 | 32.22 | 41 | 45.56 | 102 | 37.78 |
| pea grass | 56 | 62 | 49 | 54.44 | 61 | 67.78 | 166 | 61.48 |
| Soyabean | 44 | 48.9 | 49 | 54.44 | 38 | 42.22 | 131 | 48.52 |

N=Number of households; N.B. More than one response was possible

### 3.4. Purposes for Keeping Goat

Ranking of the goat production objectives by smallholder farmers in the three districts is presented in Table 4. Knowledge of reasons for keeping animals is a prerequisite for deriving operational breeding goals Jaitner *et al*. (2001). The primary reason for keeping goats for the Bahirdar Zuria district goat owners was for wealth status followed by meat consumption, cash income, saving, manure, skin and dowry, and for ceremony in that order with an index value of 0.3, 0.24, 0.19, 0.17, 0.05, 0.03, and 0.004, respectively, where as incase of Yilmana Densa district the primary reason of keeping goat was for meat consumption followed by saving, wealth status, cash income, manure, skin, ceremony, dowry and for sacrifice with ranking index of 0.25, 0.24, 0.22, 0.15, 0.06, 0.05, 0.03, 0.01 and 0.002, respectively.

In Gonji Kolela district the primary purpose of keeping goat was for meat consumption followed by saving, wealth status, manure, skin, for ceremony, cash income, dowry and sacrifice purpose with an index value of 0.29, 0.28, 0.16, 0.11, 0.06, 0.05, 0.04, 0.01, and 0.004, respectively. In contrast to this study goats in Eastern Hararghe zone (Babbile, Meta, and Gurawa districts) were primarily raised for generating income followed by saving, manure, milk, meat and skin, as medium of gift in various social circumstances, means to confer social identity and status as well as ceremonial uses Mahilet (2012).

Table 4. Purpose of keeping goat in the study area

| Purpose of keeping | Bahirdar Zuria | Yilmana Densa | Gonji Kolela |
|---|---|---|---|
| | Index | Index | Index |
| Meat | 0.24 | 0.25 | 0.29 |
| Ceremony | 0.004 | 0.03 | 0.05 |
| Wealth | 0.30 | 0.22 | 0.16 |
| Manure | 0.05 | 0.06 | 0.11 |
| Sacrifice | 0.00 | 0.002 | 0.004 |
| Skin | 0.03 | 0.05 | 0.06 |
| Saving | 0.17 | 0.24 | 0.28 |
| Cash income | 0.19 | 0.15 | 0.04 |
| Dowry | 0.03 | 0.01 | 0.01 |

### 3.5. Breeding Management
### 3.5.1. Breeding practices

The type of mating practiced in study areas were almost natural mating or uncontrolled mating within the household's flock and between neighboring flocks. The main reasons for this uncontrolled mating were lack of awareness, insufficient number of buck, and browsing time (goat flock of household and neighboring browse together). Since the mating system was uncontrolled, almost all of the farmers in the study area were not controlling their buck from mating does of another goat flock. At the same time farmers allowed their doe to be served by bucks of another goat flock. But there was some situation in which farmers did not allow serving their does by anyone else buck from the mixed flock. Among these conditions color was the major one which was considered by the goat owners in the study area. Especially, a buck with black coat color type was not allowed to mate their does.

Some of the respondents (12.96%) in the study area were practicing special management of breeding

buck. Providing the breeding buck with additional feeds like wheat bran and drugs (Albendazole), which traditionally called "*Madaberia*" were among special management practices for breeding bucks. In contrast to the current study almost all of the respondents were not practicing special management for breeding buck Mahilet (2012).

Among the respondents, 22.22% in Bahirdar Zuria, 37.78% in Yilmana Densa and 28.89% in Gonji Kolela were able to identify the sire of new born kid mostly by looking its color. According to the respondents, identifying the sire of the kid in winter season was difficult because many different goat flocks of different households were grazing on communal grazing area. Similar to this study among the interviewed farmers, 26.8% in Meta, 12% in Babbile and 23.8% in Gurawa were able to identify the sire of new born kid Mahilet (2012).

Table 5. Breeding management and practices in the study area

| | District | | | | | |
|---|---|---|---|---|---|---|
| | Bahirdar Zuria | | Yilmana Densa | | Gonji Kolela | |
| Breeding Management | N | % | N | % | N | % |
| Buck possession | | | | | | |
| • Having no breeding buck | 10 | 11.11 | 12 | 13.33 | 8 | 8.89 |
| • Having one breeding buck | 29 | 32.22 | 22 | 24.44 | 19 | 21.11 |
| • Having > 1 buck | 51 | 56.67 | 56 | 62.22 | 63 | 70 |
| Sources of breeding buck | | | | | | |
| • Own (private) flock | 72 | 80 | 64 | 71.11 | 87 | 96.67 |
| • Purchased/market | 18 | 20 | 26 | 28.89 | 3 | 3.33 |
| Purposes of keeping breeding buck | | | | | | |
| • Mating | 69 | 76.67 | 54 | 60 | 62 | 68.89 |
| • Socio-cultural | 19 | 21.11 | 23 | 25.56 | 13 | 14.44 |
| • Fattening | 80 | 88.89 | 67 | 74.44 | 57 | 63.33 |
| Special management for breeding buck | | | | | | |
| • Yes | 17 | 18.89 | 10 | 11.11 | 8 | 8.89 |
| • No | 73 | 81.11 | 80 | 88.89 | 82 | 91.11 |

N =number of household; N.B. More than one response was possible

3.5.2. Culling and market age
The mean (±SD) market age of male were 12.1 ± 2.77, 11.42 ± 2.44, and 13.39 ± 3.93 months in Bahirdar Zuria, Yilmana Densa and Gonji Kolela districts, respectively, whereas their female counterpart were 12.84 ± 3.76, 14.46 ± 3.8, and 14.48 ± 4.09, respectively. The average market age of male and female goats obtained in the current study was lower than 15.32 and 16.11 months reported for males and 15.38 and 21.93 months reported for females in Gewane and Amibara districts, respectively Seifemichael (2013). The mean (± SD) culling age of male goat in Bahirdar Zuria, Yilmana Densa and Gonji Kolela districts were 5.89 ± 0.89, 6.04 ± 1.22, and 6.43 ± 1.48, respectively, whereas their female counterpart were 10.57 ± 1.32, 11.16 ± 1.15, and 11.38 ± 1.28, respectively.

**Table 61. Mean market and culling age of goat in the study area**

| Parameter | Bahirdar Zuria | | Yilmana Densa | | Gonji Kolela | |
|---|---|---|---|---|---|---|
| | Mean | ±(SD) | Mean | ±(SD) | Mean | ±(SD) |
| **Market age (months)** | | | | | | |
| • Male | 12.1 | (2.77) | 11.42 | (2.44) | 13.39 | (3.93) |
| • Female | 12.84 | (3.76) | 14.46 | (3.8) | 14.48 | (4.09) |
| **Culling age (years)** | | | | | | |
| • Male | 5.89 | (0.89) | 6.04 | (1.22) | 6.43 | (1.48) |
| • Female | 10.57 | (1.32) | 11.16 | (1.15) | 11.38 | (1.28) |

SD=Standard Deviation

3.5.3. Castration and fattening
**3.5.3.1. Castration**
In the study area castration was primarily practiced to avoid unnecessary mating, to improve the fattening potential, to have a goat with better temperament and to acquire better price by selling the fattened goats. The main reason for not castrating goats by those farmers in all districts was lack of awareness. The reasons for castrating their goats in Bahirdar Zuria were 87.78% for control breeding, 95.56% for improve fattening, 30% for better temperament and 66.67% for better price. In Yilmana Densa 63.33% to control breeding, 92.22% to improve fattening, 32.22% for better temperament and 58.89% for better price, whereas in case of Gonji Kolela 31.11% of goat owners were castrating their goats for control breeding, 87.78% to improve fattening, 40% for better temperament and 51.11% to acquire better price (Table 7). Similar to this study Seifemichael (2013) indicated that in Amibara and Gewane districts more attention was given to improve fattening (22.7% and 24.7%).

In Bahirdar Zuria 68.89% of the farmers were providing their goats with supplementary feeds like wheat

bran, Grain, salt and local brewery by-products ("*Attela*" and "*Brint*") for about 1 to 2 weeks. According to the respondents in Yilmana Densa and Gonji Kolela districts about 84.44% and 65.56%, respectively were providing supplementary feeds. In Bahirdar Zuria district 44.44%, 20% and 35.56% of goat owners were practicing traditional, modern and combination of the two systems, respectively. In Yilmana Densa 36.67%, 26.67% and 36.67% of the respondents were using traditional, modern and combination of modern and traditional systems, respectively, whereas in Gonji Kolela district it was 46.67%, 12.22 and 41.11%, respectively (Table 7). According to the goat owners in the traditional system they used local materials such as wood, hammer, and stone (traditionally, "*Allolo*") to crush the vas deference. Similar to this study Seifemichael (2013) indicated that the most common method of castration in Amibara and Gewane districts were traditional one which was accounts 70.2% and 65.9%, respectively.

Table 7. Castration practices of goats in the study area

| Castration | B/Zuria | | Yilmana Densa | | Gonji Kolela | |
|---|---|---|---|---|---|---|
| | N | % | N | % | N | % |
| **Castration practice** | | | | | | |
| • Yes | 84 | 93.3 | 88 | 97.78 | 74 | 82.22 |
| • No | 60 | 6.67 | 2 | 2.22 | 16 | 17.78 |
| $X^2$ Value | 67.6* | | 82.18* | | 37.38* | |
| **Castration reason** | | | | | | |
| • Control breeding | 79 | 87.78 | 57 | 63.33 | 28 | 31.11 |
| • Improve fattening | 86 | 95.56 | 83 | 92.22 | 79 | 87.78 |
| • Better temperament | 27 | 30 | 29 | 32.22 | 36 | 40 |
| • Better price | 60 | 66.67 | 53 | 58.89 | 46 | 51.11 |
| $X^2$ Value | 33.17* | | 26.43* | | 31.89* | |
| **Supplementary feed for castrated goat** | | | | | | |
| • Yes | 62 | 68.89 | 76 | 84.44 | 59 | 65.56 |
| • No | 28 | 31.11 | 14 | 15.56 | 31 | 34.44 |
| $X^2$ Value | 12.84* | | 42.71* | | 8.71* | |
| **Castration method** | | | | | | |
| • Modern | 18 | 20 | 24 | 26.67 | 11 | 12.22 |
| • Traditional | 40 | 44.44 | 33 | 36.67 | 42 | 46.67 |
| • Both | 32 | 35.56 | 33 | 36.67 | 37 | 41.11 |
| $X^2$ Value | 8.27* | | 1.8ns | | 18.47* | |

N=No of households;*significant difference at $p < 0.05$

### 3.5.3.2. Fattening

In the study area the majority (98.89%) of the goat owners practiced fattening of goats. Among the feed types used for fattening in the study area were natural pasture (grazing), local brewery by-products and concentrates. They were providing their goats with some drugs like Albendazole (150 and 300 Milligrams). Most farmers in the study area were fattening their goats within 3 to 8 months. But according to Mahilet (2012) most farmers in Meta, Babbile and Gurawa district fattened their goats in the range between 6 months to 1 year.

Table 8. Categories of goats for fattening in the study area

| Type of goats for fattening | Bahirdar Zuria | Yilmana Densa | Gonji Kolela |
|---|---|---|---|
| | Index | Index | Index |
| Culled young females | 0.04 | 0.05 | 0.06 |
| Culled young male | 0.12 | 0.08 | 0.03 |
| Young females | 0.00 | 0.00 | 0.00 |
| Young males | 0.25 | 0.20 | 0.24 |
| Castrates | 0.43 | 0.38 | 0.32 |
| Older males | 0.07 | 0.13 | 0.16 |
| Older females | 0.10 | 0.17 | 0.20 |

### 3.5.4. Selection criteria for breeding buck and doe

Color, appearance and character of breeding buck ranked first, second and third for Bahirdar Zuria district goat owners with an index of 0.35, 0.32 and 0.13, respectively. In all districts the most preferred colors by the goat owners were white and white and red colors together, whereas black color was not preferred by all of the goat owners. Appearance, color and age of breeding buck ranked first, second and third for Yilmana Densa district goat

owners with an index of 0.31, 0.25 and 0.11, respectively. In Gonji Kolela district appearance, color and character of breeding buck were ranked first, second and third with an index of 0.29, 0.23 and 0.13, respectively. Twining, appearance and age at sexual maturity of breeding doe ranked first, second and third for Bahirdar Zuria district goat owners with an index of 0.27, 0.22 and 0.17, respectively and also for Gonji Kolela district goat owners with an index of 0.22, 0.20 and 0.19, respectively. According to the goat owners in Yilmana Densa district their major criteria for selection of breeding doe were twining ability, appearance and color with an index of 0.21, 0.18 and 0.17, respectively. Similar to this study Mahilet (2012) indicated that appearance, age at sexual maturity and twining ability were considered as the first three reasons for doe selection across all the study districts in eastern hararghe zone.

Table 9. Ranking of selection criteria for breeding buck and doe

| Class and selection criteria | Bahirdar Zuria | Yilmana Densa | Gonji Kolela |
|---|---|---|---|
| | Index | Index | Index |
| **Breeding buck** | | | |
| Appearance | 0.32 | 0.31 | 0.29 |
| Color | 0.35 | 0.25 | 0.23 |
| Horn | 0.00 | 0.02 | 0.01 |
| Character | 0.13 | 0.10 | 0.13 |
| Adaptability | 0.06 | 0.007 | 0.04 |
| Growth | 0.11 | 0.10 | 0.12 |
| Age | 0.02 | 0.11 | 0.08 |
| Libido | 0.004 | 0.03 | 0.05 |
| Pedigree | 0.007 | 0.06 | 0.03 |
| **Breeding doe** | | | |
| Appearance | 0.22 | 0.18 | 0.20 |
| Color | 0.12 | 0.17 | 0.12 |
| Kid survival | 0.02 | 0.02 | 0.04 |
| Kid growth | 0.13 | 0.16 | 0.14 |
| Age at sexual maturity | 0.17 | 0.16 | 0.19 |
| Kidding interval | 0.07 | 0.10 | 0.09 |
| Twining ability | 0.27 | 0.21 | 0.22 |

3.6. Major Constraints of Goat Production
According to the goat owners in the study area water shortage was not the main problem as compared to the other mentioned constraints. This finding was quite different from Grum (2010), in which water shortage was the second frequently mentioned constraint at Jeldesa and Mudianeno districts.

Table 10. Major constraints to goat production in the study area

| Constraints | Bahirdar Zuria | Yilmana Densa | Gonji Kolela | |
|---|---|---|---|---|
| | Index | Index | Index | |
| Genotype | 0.08 | 0.05 | 0.02 | |
| Feed shortage | 0.36 | 0.28 | 0.32 | |
| Water shortage | 0.004 | 0.07 | 0.09 | |
| Disease | 0.25 | 0.20 | 0.23 | |
| Drought | 0.03 | 0.16 | 0.07 | |
| Market | 0.02 | 0.05 | 0.03 | |
| Predator | 0.20 | 0.17 | 0.23 | |
| Labor shortage | 0.05 | 0.01 | 0.02 | |

3.7. Effective Population Size and Level of Inbreeding
Utilization of breeding buck/s born within the flock, uncontrolled mating, lack of awareness about inbreeding and small flock size may lead to accumulation of inbreeding and decreased genetic diversity (Falconer and MacKay, 1996; Jaitner et al., 2001; Kosgey, 2004. When goat flock of a household were not mixed, ΔF for goat in Bahirdar Zuria, Yilmana Densa and Gonji Kolela districts were 0.30, 0.19 and 0.22, respectively. These values were higher than the maximum acceptable level of 0.063 Armstrong (2006). Therefore, mixing goat flocks is recommended in this study to decrease the rate of inbreeding by increasing the effective population size.

**Table 11 . Effective population size and level of inbreeding in the study area**

| District | Nm | Nf | Ne | ΔF |
|---|---|---|---|---|
| Bahirdar Zuria | 0.50 | 2.50 | 1.67 | 0.30 |
| Yilmana Densa | 0.80 | 4.30 | 2.70 | 0.19 |
| Gonji Kolela | 0.74 | 2.49 | 2.28 | 0.22 |

$N_e$ = effective population size; ΔF = coefficient of inbreeding; $N_m$ = Number of male; $N_f$ = Number of female

## 4. Summary, Conclusions and Recommendations

### 4.1. Summary and Conclusion

The present study was done to describe production system, production constraints and to identify trait preferences and breeding practices. The overall major farming activities in the study area were mixed crop and livestock farming. All of the surveyed households in the study districts owned goat and the reasons of keeping goats in the study area were for meat, wealth, cash income, saving, ceremony, manure, skin, dowry and scarification purpose. The major crops grown for income and household consumption in the study area during the main rainy season were teff, maize and sorghum. A type of mating practiced in study areas were almost natural mating or uncontrolled mating within the household's flock and between neighboring flocks. The main reasons for this uncontrolled mating were lack of awareness, insufficient number of buck, and browsing time (goat flock of household and neighboring browse together). In study areas appearance, color, character and age were the main criteria's for selection of breeding bucks, whereas, twining ability, appearance, age at first sexual maturity and color were for does. In all districts the most preferred colors by the goat owners were white and white and red colors together, whereas black color was not preferred by all of the goat owners. The major constraints of goat production in the study area were shortage of feed resources, disease and predators in this order. When goat flock of a household were not mixed, the inbreeding coefficient for goat in Bahirdar Zuria, Yilmana Densa and Gonji Kolela districts were higher which was 0.30, 0.19 and 0.22, respectively. Generally, mixed crop and livestock rearing were the major farming activities in the study areas and the goat producers were practicing uncontrolled mating.

### 4.2. Recommendations

✓ An effort should be made to increase the proportion of breeding male in line with selection and culling of genetically inferior bucks with controlled breeding as well as training should be provided for farmers about inbreeding depression and the effect of mixing flocks on rate of inbreeding.

✓ Training should provide for goat owners to focus on economically important traits during selection and further research should be done to know more about traditional animal breeding practices.

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