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# Dairy Productive Potential, Challenges and Production opportunities of Horro and their $F_1$ Jersey Crossbred Cows: A Case of Guduru Livestock Production and Research Center and Its Surroundings, West Oromia, Ethiopia

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**Abstract**

A survey was conducted on 75 smallholder householders and 205 sample cows selected by random and purposive sampling with the objectives of investigating the challenges, potential and opportunities of production of indigenous Horro and their F1 Jersey cross heifers and cows. The means ± SDs of total farmland, cropland and grazing land holding of individual smallholder householders of the study area was 3.6±3.16, 2.86±2.51 and 0.81±0.89 respectively. The means and SDs of livestock species holdings were 17±11.66, 2.9±3.98, 2.9±4.83, 1.8 ±1.66 and 9.3±8.97 for cattle, sheep, goats, equine and poultry respectively. Breeding method of cattle used was within the proportion of 63.8% and 36.2% for natural mating, and for bull and AI services respectively for on-farm production, while both AI and controlled natural mating were used in the Research Center. The means±SD of NSPC for Horro and their Jersey crossbred heifers was 2.1±1.09 and 1.7±0.94 respectively, where NSPC was significantly influenced by breed of cattle at $P<0.05$. The overall mean ± SE milk off-take per cow per day for local and crossbred cows were 1.5±0.01 and 5.02±0.12 litres, respectively. Feeding management, breed of animal and site of production significantly influenced milk productivity at $P<0.001$ both in wet and dry seasons of the year.



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## INTRODUCTION

The Ethiopian dairy sub-sector is predominantly smallholder and subsistent-oriented. Market-oriented development of smallholder dairying has a potential to spur economic growth and alleviate poverty (Bennett *et al*., 2006). Policy and development interventions over the past six decades in Ethiopia however, had limited impact on commercialization of the sub-sector. Further growth in demand for milk and milk products spurred by rapid growth in population, urbanization and per capita income, has been the major driving force worldwide for the faster growth of the livestock sector in general (Delgado *et al*., 2002). Likewise, recent empirical evidence (Staal *et al*., 2008) shows that the development of Ethiopian dairy subsector has primarily been conditioned by the demand situation, more than the supply-side constraints.

Most of the local cattle used for milk and meat production in Ethiopia are Zebu breeds. Among these, the Fogera and Horro are known as better milk producers, the former being reared around Lake Tana in Amhara Regional State and the later mainly in Horro Guduru Wollega zone, in Oromia Regional State. The Boran, originating in the Borana plateau of southern Ethiopia, is renowned for its beef production well beyond the boundaries of Ethiopia Alemayehu (2002).

Improvement of the genetic potential of indigenous cattle in the tropics can be achieved most suitably by cross breeding high producing cattle of temperate origin with adapted indigenous cattle at a level where the advantage of hetrosis is most exploited (Mason, 1974). It has been well documented that maximum return from dairy operation depends on the use of animals with high milk output relative to maintenance cost over the annual cycle. In Ethiopia, crosses of Zebu mainly with Holstein-Friesian cattle have been used for milk production for decades (Alberro, 1983; Bekele *et al.,* 1991; Mukasa-Mugerwa *et al.*, 1991; Negussie *et al.,* 1998). Production of milk also depends heavily on reproductive performance of cows (Kiwuwa *et al*, 1983). The traditional milk production system, which is dominated by indigenous breeds of low genetic potential for milk production, accounts for about 97 percent of the country's total annual milk production by Felleke (2003).

The low productivity of the country's dairy production in general and of the study area in particular is mainly attributed to shortage of crossbreed dairy cows, lack of capital by dairy producers, inadequate animal feed resources (in quality and quantity) and unimproved animal husbandry systems. Inefficient and unimproved milk processing materials and methods, low milk

production and supply to milk processing centers and poor marketing and market information systems are also the other challenges. The objectives of this study were therefore, to determine dairy production performance of local and crossbred cows in the area and to identify challenges and potential of dairy production, processing and marketing.

## MATERIAL AND METHODS

### Description of the Study Area

The study was conducted at Guduru Cattle Improvement and Research Center of Wollega University and five surrounding smallholder householders' farms, in Guduru district of Horro-Guduru Wollega zone, Oromia Regional State, Ethiopia. The Research Center is located at about 300 km west of Addis Ababa (the capital city of the country). The study area is located at 09º29´N and 37º26´E and at an altitude of approximately 2296 m.a.sl geographical coordinates. The area has one long rainy season extending from March to mid-October Olana (2006). According to the 2010/11 annual report of Guduru District, the monthly mean temperature varies from 14.9$^0$C to 17.5$^0$C and annual rainfall ranges from 1000-2400 mm. Mixed crop-livestock agriculture is the dominant production system in the area.

### Study Animals

Animals considered by the study were Horro and Horro-Jersey $F_1$ crossbred cows and heifers in the Research Center and smallholder's dairy cattle of five administrative *kebeles* (the smallest administrative structures in the country) surrounding the research center. Horro cattle breed has traditionally been used for draft power, milk and beef production in low-input production systems. Horro cattle breed/type is classified as an intermediate (Sanga-Zebu). It is medium to large in size with a small and finely shaped head, a straight profile and medium to large horns that are definitely larger than Ethiopian Zebu breeds by Alberro and Haile-Mariam (1982).

### Breeding Program of the Research Center

In the Research Center, Horro cattle breed improvement programs had been going on since the year 2003 by selection and crossbreeding. For the crossbreeding purpose, semen from two exotic sire breeds, Holstein Frisian (HF) and Jersey (J) was obtained from the National Artificial Insemination Center (NAIC) to inseminate Horro cows that were used as dam line. The foundation stocks local zebu (Horro breeding bulls and cows) were purchased from local markets of Amuru, Jarte, Dongoro and Horro districts of Horro-Guduru Wollega zone. Selection of local breeding bulls and cows was performed based on the phenotypic appearance of the animal.

### Herd Management

All calves born on-station/ in the research center were weighed at birth and identified by ear tags. But, no identification method was used under smallholders' condition. Lactating cows were milked twice a day by hand in the presence of their calves both on-station and on-farm. However, cows under smallholder farmers' management were milked twice a day being agitated for the milk let down by suckling. The second milking conducted during each milking is termed "Chicha" in Afan Oromo (a language spoken by Oromo people), a system used for complete milking. The milk harvested was measured and recorded on milk product record books. The smallholder farmers who owned $F_1$ crosses managed their animals under mixed crop-livestock production system and supplemented the crossbred milking cows with concentrate, local beers' left over, noug seed cake (*Guizota absysinica*) and wheat bran according to their level of awareness.

### Data collection and Statistical Analysis

Data on production system, farmland and livestock holding, reproductive and production performances, livestock husbandry and health problems were collected by interviewing sample smallholder householders. Dairy production variables considered in this study include dairy traits such as milk off-take per day (DMY), lactation milk yield (LMY) and lactation length (LL), and milk product processing practices and potentials. DMY, LMY and LL were analyzed with the Procedure General Linear Model (GLM) in SAS, (SAS, 2002) and descriptive statistics in SPSS ver. 16 was used for survey data analysis.

## RESULTS AND DISCUSSION

### Husbandry and Management

About 60% of the respondents (n= 45) were using free stall/fence shelter at their backyard for their cattle during nighttime while about 30.7% (n=23) of them use traditional barn where only 9.3% (n=7) of the respondents reported that their animals were kept in both free stall/fence and traditional barn. The traditional barn (houses prepared by thatch cover) was mainly used for crossbred animals, calves, milking cows and oxen by order.

**Table 1:** The proportion of housing methods used and milking management

| Variables | Number of household | Frequency (%) |
|---|---|---|
| **Housing management** | | |
| Fence/free stall | 45.0 | 60.0 |
| Traditional barn | 23.0 | 30.7 |
| Both | 7.0 | 9.3 |
| **Cow milking responsibility** | | |
| Women | 40.0 | 53.3 |
| Women and girls | 34.0 | 45.3 |
| All family members | 1.0 | 1.4 |

The free-stall/ fence barn does not have sheds and is mobile type. It is constructed from locally available materials (i.e. trees) to protect animals from wild beasts and sometimes from crop damage during night. The respondents indicated that they change the position of the free stall/ fence every two weeks (during rainy season) and at about three weeks interval during dry season. The dung of the animals was used to fertilize crop fields. Therefore, free- stall cattle barn was constructed with a plan to use livestock manure as an organic for back yard crop and vegetable cultivation. Men family members participate in barn construction while women take part in barn cleaning and milking cows. Adult males and females are normally assumed to be different in terms of the amount of effective work they can do, though there may be some tasks (e.g., in cropping) where their work output will be equal.

Cow's milking is found mainly to be the duty of female family members (Table 2). House-wives, mothers and

daughters are responsible for milking cows. Samuel (2005) also reported that female family members were responsible for milking cows at Yerer water shade, Adea district of Oromia administrative region.

**Feed Sources and Feeding System**

The main sources of livestock feeds of the study area were: natural pasture (grazing), crop residues, crop aftermaths and in few cases cultivated forages. Feed supplements such as grass hay, crop residue, kitchen waste leftover (Diky/Local name for local brewery and liquor residue), concentrate, green chops of Napier grass, vernonia (*Vernonia amygdalina*), *Sesbania sesban* and salt were also commonly used, (Table -2) that meets to the report by (Anteneh, 1984; Alemayehu, 1987). However, the number of householders using a given plot of communal grazing area differs from village to village.

**Table 2:** On-farm means and SDs of milk off-take of Horro and Horro-Jersey $F_1$ crosses' as influenced by season and feeding system

| Breed of Animal | No of HH | Type of feed and feeding system | Milk off-take (liter/day) | | | |
|---|---|---|---|---|---|---|
| | | | Rainy season | | Dry season | |
| | | | Mean milk off-take (SD) | Level of significance | Mean milk off-take (SD) | Level of significance |
| Horro | | | | | | |
| | 29 | Cg, Cr, Gh, Kw | 2.1 ±0.8 | | 1.3 ±0.6 | |
| | 13 | Cg, Cr | 1.3 ±0.2 | ** | 0.9 ±0.1 | ** |
| | 18 | Cg, Cr, IF, Kw | 2.1 ±0.6 | | 1.5 ±0.6 | |
| | 15 | Cg, Gc, Cr, Kw | 1.6 ±0.6 | | 1.1 ±0.5 | |
| (H J) | | | | | | |
| | 9 | Cg, Cr, Gh, Kw | 6.8 ±2.3 | *** | 5.5 ±1.8 | ** |
| | 3 | Cg, Cr | 6.3 ±0.6 | | 4.0 ±1.0 | |
| | 5 | Cg, Cr, IF, Kw | 7.5 ±1.4 | | 6.0 ±1.0 | |
| | 4 | Cg, Gc, Cr, Kw | 5.6 ±3.2 | | 4.8 ±3.1 | |

Cg= communal grazing, Cr= Crop residue, Gc= Green chops, Gh= Grass hay, IF= Improved forage, Kw= Kitchen waste leftover, HJ= Horro Jersey $F_1$ crosses, ***= highly significant at P<0.001;**= Significant at p <0.01

The communal grazing lands used during the dry season of the year were mainly swampy (marshy areas) that could not be used for crop cultivation and riversides that possess some green forage materials. Cattle prefer these areas during the dry season of the year because of access to water and green forage availability. Smallholders who use improved forages, grass or legume, in both the rainy and dry season had produced more mean daily milk yield. This study revealed that cows which relies only on communal grazing land and crop residue, whether they are crossbred or local, produce the lowest average milk yield/day which was 1.25 and 0.9 lit/day during rainy and dry seasons, respectively. Some cows produce very little milk that is barely enough to feed their own calves and leave some milk for the farmers' children.

**Livestock Disease Problems and Treatment Measures**

Different livestock diseases were identified in this study, which further lowers the productivity of the dairy production system due to high morbidity and mortality. Among these: trypanosomiasis, anthrax, black-leg, bovine pasteurellosis, lumpy skin disease (LSD), contagious bovine pleuro- pneumonia (CBPP), mastitis, calf scour, skin diseases, internal and external parasites, bloating and calf pneumonia were the major ones. Particularly, trypanosomiasis, mastitis, ticks and different skin diseases cause considerable losses to the productivity of dairy cows in the area. The status of major health problems and prophylactic and curative practices in the area are summarized in (Table 3). The reaction of livestock owners to these animal diseases are clinical and traditional treatments and/or reliance on both measures.

**Table 3:** Common livestock health problems and treatment measures practiced

| Livestock diseases | Clinical | | Traditional treatment | | Both | | No treatment | |
|---|---|---|---|---|---|---|---|---|
| | No | % | No | % | No | % | No | % |
| Mastitis | 40 | 69 | 2 | 3.4 | 16 | 27.6 | - | - |
| Repro. health Problems | 54 | 75 | 1 | 1.4 | 3 | 4.2 | 14 | 19.4 |
| Ecto-parasite | 53 | 73.6 | - | - | 14 | 19.4 | 5 | 6.9 |
| Skin diseases | 59 | 81.9 | 1 | 1.4 | 4 | 5.6 | 8 | 11.1 |
| Bloat | 24 | 33.3 | 8 | 20.8 | 33 | 45.8 | - | - |
| Calf scour | 48 | 66.7 | 3 | 4.2 | 1 | 1.2 | 20 | 27.8 |

Most smallholders used clinical treatment measures at nearby veterinary clinics while some use traditional treatments against mastitis, reproductive health problems, skin diseases, bloating and calf scour though most of these traditional treatments were less efficient. About 81.9%, 75%, 73.8%, 69%, 66.7% and 33.3% of respondents used clinical treatments against reproductive health problems, skin diseases, ecto-parasites, mastitis, calf scour and bloating, respectively. Most respondents (66.7%) used both traditional and clinical treatments for bloating, which might be due to its acute nature. However, 19.4%, 6.9%, 11.1% and 27.8% respondents did not take any action against reproductive health problems, ecto-parasites, skin diseases and calf scour, respectively.

**Milk Production Performances**

The mean milk yield and lactation length of Horro and Horro-Jersey crossbred cows are summarized (Table-4).

The overall mean±SE daily milk off-take per cow per day for Horro and their $F_1$ Jersey crossbred cows were found to be 1.5±0.1 and 5.02±0.02 liters, respectively. During rainy season, mean milk yield of Horro cows per day was about 1.7±0.3 and 2.1±0.67 liters under on-station and on-farm management, respectively. The mean daily milk off-take for same season for Horro-Jersey crosses maintained under on-station and on-farm management was 4.7±0.75 and 6.7±2.67 liters, respectively. The mean ± SE daily milk off-take for both breeds/genotypes was highly reduced during the dry season, which might attributed to feed scarcity during the dry season of the year. Breed of cows, season of lactation and management were significantly influenced (*P*<0.001) cows' milk yield per day and per lactation.

The mean daily milk yield found for Horro-Jersey crossbred cows in this study is comparable to the 5.6 kg/head/day reported for F1 (Zebu x exotic) and 6kg/head/day for high grade crosses reported by (Kiwuwa *et al.* 1983). The mean daily milk off-take of about 1.5± 0.72 liters found for local Horro cows in the current study is slightly higher than the average daily milk yield (1.02 liters) in southern Ethiopia reported by Fekadu (1994) and the 1.24 litres reported for local cows in Mieso District, in the eastern part of Ethiopia by Kedija (2008). However, it is slightly lower than the 1.8 liter/day reported by Alganesh (2002) for same breed in the different districts of East Wollegga zone. It is also in close agreement with the 1.6 liter mean daily milk yield reported by Zelalem and Ledin (2001).

**Table 4:** On- station and on-farm mean milk off-take and lactation length of Horro and their F1 Jersey crossbred cows

| Source of variation | No of cows | Means ±SE and level of significance |
|---|---|---|
| **Season of lactation** | | *** |
| Rainy | 160 | 3.8 ± 0.1 |
| Dry | 179 | 2.6± 0.8 |
| **Breed of cows** | | *** |
| Horro | 258 | 1.5± 0.1 |
| Horro-Jersey | 87 | 5.02± 0.1 |
| **Site of production** | | *** |
| On-Station | 130 | 2.75± 0.1 |
| On-farm | 209 | 3.72± 0.1 |
| **On-farm lactation length** | | Ns |
| Horro | 74 | 10.2±0.3 |
| Horro-Jersey | 22 | 10.7±0.6 |

***= highly significant at P<0.001; Ns= Non significant

Cows kept under on-farm management were more productive than those kept on-station irrespective of their breed (Table-4). The significant difference in milk productivity of cows kept under the two management system might be attributed mainly to poor feeding management, milking and calf suckling practice and the higher volume of milk left for calves on station in contrast to the complete milking practices used on-farm. The variation in mean daily milk yield between the breeds/genotypes found in the study could be attributed to genetic differences and the different feeding and housing managements offered to the animals. Smallholder households offer preferential treatments to crossbred animals while local animals are left on their own even during dry season when feed is scarce. A difference in daily milk yield during the dry and rainy seasons is attributed to availability of feeds both in quantity and quality.

In the current study, irrespective of season of lactation and type of management (i.e. on-station and on-farm managements), Horro-Jersey crossbred cows' daily milk off-take was two to three fold higher than their local counterparts. This result agrees with the report of 5.6 kg/head/day for F1 (Zebu x exotic) and 6 kg/head/day for high grade crosses by Kiwuwa (1983). Zelalem and Ledi (2001) also reported an average daily milk yield from crossbred cows to be 4.5 liters.

The overall average lactation lengths of local Horro and Horro-Jersey crossbred cows are about 10.2 and 10.7 months, respectively. The mean lactation length of Horro cows is shorter by about fifteen days than the lactation length of the F1 Jersey crosses. The lactation lengths observed for both local and crossbred cows in this study were slightly in line with the lactation length (11months) reported by Fekadu (1994), the 11.7 months reported for crossbred cows in the Central Highlands of Ethiopia by Zelalem and Ledi (2001) and the 10.5 months reported for Horro cows by Laval and Assegid (2002). However, it was much higher than the average lactation length of 7.3 months reported for local cows at Meiso district, by Kedija (2008) and the national average of 7 months reported by the CSA (2005). It was also much higher than the seven and eight months reported by Mukasa-Mugerwa (1989) for indigenous cows and the Boran cattle breed in Kenya.

The lactation milk off-take calculated for Horro and their $F_1$ crosses under the study were found 455.5 and 1645 liters, respectively. Lactation length for the former was 305 days while it was 321 days for the later. The average lactation milk off-take obtained for local Horro cows agrees with lactation milk yield (488 liter) reported for local cows found in Somali region (IPS, 2000), where it was lower than the 524-liter mean lactation milk yield reported by (Mukasa Mugerwa *et al*. 1989) for local Zebu cows under traditional management. However, it was higher than the 271.4 and 238.35 liter lactation milk yields reported for local cows in Mieso district, Oromia administrative region by Kedija (2007) and for Fogera cows by Mulugeta (2005). Nonetheless, the lactation milk yield of Horro-Jersey found in this study was in-line with the mean lactation milk yield (1120 to 1835kg) reported by Aboagye (2002) for Jersey-Ghana short horn crossbred cows.

**Dairy Product Processing and Marketing**

The (means±SD) butter yield and cheese per liter of milk for both Horro and Horro-Jersey crossbred cows are indicated (Table 6). In the current study about 21.2 liter of Horro cows' milk yields 1kg butter while only 17.0 liter of the Horro-Jersey crossbred cows' milk yield 1kg butter. The efficiency of Horro-Jersey crossbred cows' milk in production of cottage cheese (*Ayib*) and butter in comparison to local cows was much higher (Table 6). Fresh milk, fermented milk, butter and cottage cheese (*Ayib*) were among the common dairy products produced and consumed in the area with varying degrees. At household level, fresh milk and fermented milk were not commonly consumed on daily basis, as they were reserved for further processing.

The consumption pattern is defined as the combination of the types, quantities and frequencies of dairy product consumption (Mullins *et al.*, 1994). These parameters are closely linked to householders' identical location with respect to urban neighborhood, age of children in the family and income classes. In general, this study showed that more butter and cheese yield can be obtained from crossbred cows than that from local Horro cows (Table-6). The result also revealed that by processing less amount of Horro-Jersey crossbred cows' milk, more butter and cottage cheese yield could be collected and more income obtained.

Among many reasons reported by farmers, insufficient amount of milk production and cultural restriction were the most common hindering factors for fresh whole milk marketing. Same problem was reported by Alganesh (2002) who conducted her study in East Wollega Zone. According to the author, about 21.3% and 19.0% of women in East Wollega zone (neighboring zone to the study area) did not sell fresh milk due to scarcity and cultural restriction, respectively. Because of low milk production per cow per day and the preference of producers to process milk in the traditional sector, little or no fresh milk was usually available for sale.

**Table 5:** Means and standard deviation of volume of milk processed to a byproduct

| Variables | No | Mean | SD | Variance |
|---|---|---|---|---|
| Local cows' volume of milk used to produce kg of butter (lit) | 71 | 21.2 | 5.8 | 33.4 |
| Local cow's volume of defatted sour milk used to produce kg of *Ayib* | 47 | 10.8 | 5.7 | 31.9 |
| H x J cow's volume of milk used to produce kg of butter (lit) | 21` | 17.0 | 4.9 | 23.9 |
| H x J cow's volume of defatted sour milk used to produce kg of *Ayib* | 15 | 7.3 | 3.7 | 13.9 |

Tesfaye and Ranjitha (2007) concluded that selling raw milk is more profitable for dairy producers than processed products under the prevailing conditions. Nevertheless, smallholders in the study area prefer selling milk byproducts to fresh and fermented milk. The reason for milk processing was that, in addition to increasing milk shelf life, milk processing was found to give chance of producing cheese and other dairy byproducts, which were further used as protein source being a food supplement. Reasons for preferring milk processing to selling raw milk were: distance of market places, unavailability of milk processing centers in the area and the short shelf life of fresh milk.

## CONCLUSIONS

Cattle in the study area were mainly kept for farm work while milk, meat, skin/hide and animal manure are by products. The higher number of cattle per household is an indicator of the the primary importance of cattle in the agricultural production system and livelihood of the society. Significant differences were observed among the individual farmers in landholding which mainly was an indication of wealth status. Livestock feeding management, housing and health care were poor in both study sites where feeding management result in a difference on dairy productivity. Cows of householders possessing crossbred animals were more productive than those kept on-station and cows of householders not possessing crossbreeds.

Horro-Jersey crossbred cows were more productive than local Horro cows, where more productivity might attributed to genetic difference between the cross and indigenous animals. Smallholder farmers possessing crossbred cows give more attention to their animal management than those who have only local cattle. Feeding management, housing, veterinary care and milking management difference among smallholders and between farmers and the research center were good indicators of effect of husbandry on improvement on animal productivity. Horro-Jersey crossbred cows were also more productive in butter and ayib (local cheese) yield and quality in comparison to local Horro which again make producers prefer milk processing to raw milk marketing.

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