Eth. J. Anim. Prod. 2(1)- 2002: 97-114

Traditional Horro Cattle Production in Boji District, West Wellega (Ethiopia)

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Abstract

Inputs and outputs of traditional Horro cattle farming were monitored during the year 2001 in Boji District, West Wellega, located in the highlands of western Ethiopia. Inputs such as feeding and veterinary care were low. Milk and butter production, calf growth and animal work were also monitored. The mean lactation length was 314 ± 91 days. The total lactation milk yield was found to be 587 litres, 37% of which was suckled by the calf. The average yearly household butter production was 31.5 ± 8.9 kg. The retail butter price was 14.10 Birr/kg. The mean body weight one week after birth was 15.2 ± 3.0 kg and the daily weight gain from birth to 6 months was 110 ± 41 g. Oxen were worked seasonally for about 101.7 days per year, ploughing being the major (89%) activity. Low production performance is explained by prevailing feed shortage during dry season, inappropriate calf management, widespread animal diseases and low genetic potential. The urgency to increase livestock productivity in this overpopulated highland area by way of designing and implementing appropriate policies was recommended. In addition, the need to conduct on-farm productivity research was indicated as part of the means to find long term solutions to the existing constraints.

Keywords: Productivity research, on-farm research, herd monitoring, Horro cattle, Boji

Introduction

Livestock productivity in Africa is the lowest in the world. Of countries within the continent Ethiopia, in this respect, stands among the least (ILRI, 2000). In Africa, during the 1980's, more than 90% of all cattle were kept under traditional management system (De Leeuw and Wilson, 1987). Currently, in Ethiopia 85% of the 65 million inhabitants is a rural population, mainly composed of smallholder farmers whose livelihood is dependent on both agriculture and livestock. Prevalence of suboptimal nutrition and

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widespread animal diseases are the two major constraints on livestock productivity in Ethiopia (Zenash Sileshi *et al*., 2001).

Most of the researches on cattle productivity in Africa, including Ethiopia, have been carried out on research station or on modern management systems (dairy farms, commercial ranches). In Ethiopia, few researches were undertaken to study livestock production under traditional husbandry mainly dwelling in the highlands mixed crop-livestock production system (Gryseels *et al*., 1989; Mukasa-Mugerwa *et al*., 1989). The latter generally showed low performances of zebu cattle in the country.

In Ethiopia, the population is growing at a rate of 3.2% per year (Cordellier and Didiot, 1997) and demographic projections show a doubling of the existing figure within the next 25 years. In this alarming context, on farm research aiming at optimising productivity of livestock is an urgent matter. The suggested productivity research first needs to quantify performance indicators and identify limiting factors leading to the formulation of appropriate recommendations.

On-station research on production of Horro cattle has been studied at Bako (Legesse Dadi *et al*., 1992 ; Mulugeta Kebede *et al*., 1993). In addition the reproductive and demographic performances of Horro cattle in Boji district (West Wellega) were described by Lesnoff *et al*. (2002). On farm research outputs on this indigenous cattle breed are virtually non-existent. The objective of this paper was therefore to quantify inputs to cattle farming and production performances (milk and butter production, calf growth and work) using recommended appropriate indicators (ILCA, 1990). In addition costs of inputs and monetary values of animal productions are estimated, limiting factors affecting performance discussed and recommendations made.

Materials and Methods

Description of the Study Area

Geographic and climatic characteristics of the Boji district

Boji district is located in West Wellega (Western Ethiopia) at latitude of 9.36° N and longitude of 35.59° E and with a surface area of 966.1 km^2.

The district is inhabited by a population of 100,300 (CSA, 2001) corresponding to a density of 103.8 inhabitants/km^2. The area is predominantly classified as “Woynadega” (middle altitude) zone with an altitude varying from 1200 to 2100 m. asl. (Amare Getahun, 1978). The rain is monomodal in pattern and occurs mainly between May and October with a peak in July. The annual rainfalls in district vary between 1300 and 2000 mm (West Wellega Zonal Agricultural Office, 2002, personal

communication). The year is divided into 4 seasons of 3 months: *Bona* (dry season) from December to February, *Arfasa* (beginning of the rainy season) from March to May, *Gana* (main rainy season) from June to August and *Birra* (spring) from September to November.

The production system

The agricultural production system in Boji district is essentially mixed crop-livestock farming with small farm size and a subsistence economy. Cattle farming, with an average herd size of 10.5 heads of cattle, plays a major role in the production system (Laval et al., 2002). Livestock are mainly kept for farm works, oxen being used in ploughing activities. Manure, milk, butter and live animals are also important in the production system. Manure is used only as an organic fertiliser but never as fuel as is the case in other parts of Ethiopia. Milk is traditionally processed to butter and cottage cheese for both in house use and as a source of cash income for the family. Live animals may be sold at the local markets or slaughtered, the meat and hides being consumed by farm households. The demographic and reproduction parameters of cattle in the district were depicted by Lesnoff et al. (2002) (Table 1). An additional feature is the practice of oxen exchange (referred locally as *goubo* contract) through loans among individual farmers expressed in a form that a farmer lending an ox for traction in exchange for a share of part of the crop produced during the harvest period (Laval et al., 2002). Small ruminants production is not well developed in Boji district.

Table 1. Estimated annual probabilities of cattle mortality, slaughter, sale and lending out by age class (0 to 12 months, 1 to 3 years and ≥4 years (48 months) in 70 herds in Boji district for one year (2001).

	Females			Males		
	0 to 1	>1 to 4	>4	0 to 1	>1 to 4	>4
Mortality	0.163	0.094	0.029	0.160	0.087	0.026
Slaughtering	0.000	0.000	0.012	0.000	0.000	0.010
Sale	0.009	0.062	0.044	0.010	0.045	0.115
Lending out	0.170	0.341	0.336	0.200	0.451	0.390

Study Design

Herd monitoring

The herd monitoring method was employed to quantify production performances and inputs of cattle farming in the study area as per the recommendation of Faugère and Faugère (1986), ILCA (1990), De Leeuw *et al.* (1995) and van Klink *et al*. (1996) for animal productivity research to collect reliable and accurate data.

Seventy selected herds as representatives of the highland at 15 km radius from the capital of Boji district (Bila) were monitored for one year (December 2000 to November 2001). Each animal was ear-tagged for permanent identification. The monitoring process had demographic and health components. Trained enumerators visited the herds every two weeks to record all demographic events, the reasons of these events (birth, death, slaughtering, purchase, sale or loan) and, in case of trade, the sale price. Clinical signs of sick animals and the type and cost of veterinary care applied were also registered. Animal production data were collected from the 13 of the 70 herds for a period covering from December 2000 to January 2002. The animals belonged to 18 smallholder farmers (some herds were shared between two or more farmers). Selection of these herds was based on the presence of cows beginning to lactate at the start of the monitoring. Animal production data collected included milk and butter production, calf growth, animal work and animal feeding. Manure production data was not monitored in this study. Required labour for animal keeping was investigated through interviews with farmers.

Milk and butter production monitoring

A total of 63 lactating cows with delivery dates accurately known were monitored. Of these, only 34 were monitored for the entire lactation period. 25 of the cows delivered during the period from October to December 2000, composing a cohort, whose lactation curve is shown on Figure 1. Two enumerators visited each farm morning and evening once a week. The quantity of milk collected for human consumption (milk off-take) from each lactating cow was measured with a calibrated glass (cl). The quantity of milk consumed by the calf was measured for 30 calves as per the method described by ILCA (1990). The latter consisted of weighing of calves before and after suckling with a scale (0.1 kg accuracy). Weekly butter production (sold or consumed) in 18 households was monitored from December 2000 to January 2002. It was measured with a scale (25g accuracy). The sale prices were recorded.

Calf growth monitoring

The weekly body weight of 19 calves (12 females and 7 males) was measured from first week after birth up to the age of 6 months. Due to deaths and animal movements (exchanges, sale), 17 calves only were present 3 months after birth and 12 at the age of 6 months.

Animal work monitoring

Number of days and length in a day of work, nature of the work and beneficiary (owner or other farmer) were recorded for 60 male cattle aged more than 4 years. Because of the high frequency of animal exchanges between farmers, only 12 oxen were available and monitored continuously for one year

for the work provided at own farm and outside. Three types of work were distinguished, namely traction, threshing and trampling. The monetary value of traction work was estimated from 10 *goubo* contracts (animal loans) recorded.

Animal feeding practice monitoring

Supplementary feed given to cows and oxen (type, quantity, and price) was recorded weekly and compiled on monthly basis.

Performance Indicators and Statistical Analysis

The total lactation milk yield and the lactation length are the most relevant indicators of milk performance in subsistence systems (ILCA, 1990). Hence, the total lactation milk yield in this study was calculated as the sum of the average weekly milk production (for lactating cows only) for the whole lactation period (from 1st week after delivery to last week of lactation). The annual milk yield per cow was calculated as total lactation milk yield multiplied by calving rate. The latter is computed for adult females (>4 years) as the average number of calving/year (Lesnoff et al., 2002). Calving rate was estimated to be 0.371 $years^{-1}$.

Calf growth is computed as the average daily weight gain, as per ILCA's (1990) recommendation. A weight/consumption conversion factor, defined as the quantity of milk (litres) consumed by a calf before weaning for 1 kg of body weight gain, was calculated for the first 3 months. T-test statistics was used to compare means of lactation lengths between cows of various lactation numbers and calf weight and weight gains between sexes.

Work performances were described with the total yearly work production per animal, calculated as the summation of the individual weekly average days of work (for working males only) in a year.

The rate of veterinary treatments use per animal was computed with the "hazard rate" (or instantaneous risk). For an homogeneous set of individuals, the hazard rate μ (if assumed constant with age) of a specific event (e.g. treatment) can be estimated by the ratio y/T, where y is the number of observed cases of this event (e.g. the number of treatments) and T the total time at risk (Lee, 1992).

Statistical analyses were performed employing SPSS Base 10.0 (1999), a computer-based statistical software.

Results

Herd Composition

The 13 herds selected for animal production monitoring were of various sizes from small (4 animals) to large (30 animals) with an average number of
17.5 heads of cattle. During the year 2001, each of the 18 farmers owned an average of 12.7 animals including 4.8 adult females (above 4 years), 50% were in lactating, and 2.6 adult males.

Inputs

The inputs to livestock farming included labour, animal feed and veterinary care.

Labour was required for animal herding. The herders were often family members (young boys) who are always available when needed. For bigger herds, a herdsman, often a young boy from a poor family, was sometimes employed with the salary rate of 80 to 100 Birr per year plus full boarding provisions.

Pasture was the main feed in the existing traditional production system. Leaves from natural trees were also provided during the end of the dry season when the main feed-resource base was scarce. Lactating cows and working males were supplemented with crops grain (maize, sorghum and millet), at an average rate of 4 kg/working male/year (mostly in September), and 8.5 kg/lactation for cows. Lactating cows were also supplemented with residues of local brewery (arake) and maize or sorghum seedlings (all together on average 24 kg/lactation). Salt was provided to lactating cows and working males at an average rate of 2.3 kg/lactation and 3.8 kg/year, respectively. The supplementary feeding cost for the full lactation period was estimated to be 15.70 Birr (1 Birr = 0.118 US$ in 2001). Supplementary feeding of males was seasonally linked to the presence of agricultural activities and its cost was estimated at 9.70 Birr/animal/year.

The yearly hazard rate of treatment administration was 0.090 and the yearly average cost of veterinary care / animal (all categories considered) was estimated at 0.48 Birr. Only 7% of the antibiotics and 3% of other treatments were provided by the public services, while all other health cares were delivered either through private services or informal markets (smugglers, farmers themselves or healers). Veterinary inputs are shown in Table 2.

Milk and Butter Production

The mean ($\pm$ SD) lactation length of Horro cattle in Boji was 314.3 $\pm$ 91.4 days with the median, minimum and maximum values of 291.5, 145 and 530

days, respectively. The lactation period was longer for cows at ≥ 4 lactation and lower for those at 2nd and 3rd lactation (Table 3). The variation, however, was not significant ($p>0.05$). The average total lactation milk yield calculated for 45 weeks was 587.2 litres. Out this, 369.1 litres (62.9%) were destined for human consumption and the remaining 218.1 litres was suckled by the calf. The average daily milk yield and milk off-take were 1.86 and 1.18 litre, respectively. The mean annual milk yield was 217.9 litres. Figure 1 shows a calendar related lactation curve for a cohort of 25 cows. The average household production of butter for year 2001 was 31.5 ± 8.9 kg/household, of which 12.9 ± 4.7 kg (41%) was sold. The average monthly butter sold at household level was relatively stable throughout the year, irrespective of the level of variation in the production (decrease at the end of the dry season).

Table 2. Yearly veterinary inputs of livestock farming in relation to categories of animal (age-sex groups) from 70 herds in Boji district (1st December 2000 to 30 November 2001).

Animal categories	Type of treatment	Yearly hazard rate of treatment	Average cost of treatment (Birr)	Yearly average cost per animal (Birr year^{-1})
Calves	ATB[a]:	0.005	1.35	0.01
	Other[b]	0.033	1.25	0.04
Heifers (1-4 years)	ATB	0.031	6.13	0.19
	Other	0.031	2.71	0.08
Females above 4	ATB	0.048	8.04	0.39
	Other	0.065	4.28	0.28
Bulls (1-4 years)	ATB	0.029	5.67	0.16
	Other	0.019	3.00	0.06
Males above 4	ATB	0.067	7.63	0.51
	Other Castration	0.058	3.93	0.23
		0.049	0	0
All categories	ATB	0.041	7.28	0.30
	Other	0.049	3.76	0.18

[a] ATB: Antibiotic treatments: they include oxytetracycline and penicillin

[b] Other: other treatments than antibiotics: they include anthelminthics, trypanocides, and traditional treatments

Table 3. Mean lactation length and total lactation milk yield in relation to lactation number in 13 herds, Boji district, West Wellega, Ethiopia (2001)

Lactation number	number 1	number 2 and 3	> number 4	All numbers
Sample size	5	21	8	34
Mean lactation length (days)	320.2	293.4	365.4	314.3
	(46 weeks)	(42 weeks)	(52 weeks)	(45 weeks)
Standard Deviation (days)	89.0	83.4	103.1	91.4
Total lactation milk yield (litre)	622.9	566.4	626.5	587.2

Calf Growth

The mean body weights of calves at one week, three months and six months of age were 15.2 ± 3.0, 29.8 ± 7.1 and 35.0 ± 8.6 kg, respectively. The minimum and maximum body weight recorded at one week of age was 9.8 and
23.0 kg, respectively. Average daily weight gains of calves at the various ages are shown in Table 4. There was no statistically significant difference ($p>0.05$) in mean body weight and weight gains at various ages between male and female calves. The weight/consumption conversion factor amounted to 8.9 litres of milk/kg of weight gain.

Animal Work

A total yearly work of 101.7 days, of which 90.5 days (89.0 %) for ploughing, 8.3 days (8.2 %) for threshing and 2.9 days (2.8 %) for trampling was obtained. The average daily ploughing duration was 4h33 ± 0h40, with a range of 2 to 6 hours and seasonal variation (Table 5 and Figure 2). The results revealed that months of maximal work were June, July and August with 13.3, 17.7 and 14.1 days of work, respectively. Conversely, the months of minimal work were March and April with 2.5 and 0.9 days of work, respectively. Oxen were used for threshing from December to March, after the crops harvest, and for trampling mostly during August at the time of preparation of *tef* fields.

From the data on 12 oxen (complete year-round information), it appeared that 78.4% of the traction work was done for the owner's benefit (ploughing own land), 15.3% was provided to another farmer through a goubo contract and 6.3% was provided to a neighbour or relative in kind or free of charge. An average of 14.8 ± 11.8 days of goubo contract per year was recorded.

Table 4. Average daily weight gain of Horro breed at various stages of growth in 13 herds in Boji district, West Wellega, Ethiopia (2001).

Daily weight gain	Birth - 3 months	Birth – 6 months	3 – 6 months
Average (kg)	0.157	0.110	0.063
SD (kg)	0.061	0.041	0.046
Minimum (kg)	0.058	0.048	-0.007
Maximum (kg)	0.242	0.186	0.133
Number of records	17	12	12

Table 5. Characteristics of on-farm traction activities in relation to the 4 seasons in 13 herds in Boji district, West Wellega, Ethiopia (2001).

	SEASON			
	Bona (dry season)	Arfasa (beginning of rainy season)	Gana (main rainy season)	Birra (spring)
Work duration (hours)	4:22	5:04	4:53	4:05
Number of days of traction (days)	21.3	10.3	44.2	15.9
Distribution of traction days within the year (%)	24%	11%	47%	18%
Number of days of goubo contract[a] (days)	1.8	2.8	8.2	2.1
Distribution of contract days within the year[a] (%)	12%	19%	55%	14%

[a] calculated from 12 oxen followed 365 days continuously during year 2001

Monetary Value of Animal Production

The average producers' price of 1 kg of butter in the study area was 14.10 Birr during the year 2001. The monthly values varied from 17.30 Birr in April to 11.50 Birr in November. In January 2002, butter price was 13.00 Birr, which showed a decrease of 22% as compared to January 2001 (16.70 Birr) (Figure 3). In the year 2001 the average household yearly income from butter sale was found to be 185 $\pm$ 65 Birr.

Through *goubo* contract system, 160 kg of sorghum was exchanged for 30 days of traction work by a single ox. In monetary terms, a day of traction work by rented ox was thus estimated to be 2.70 Birr.

The estimated sale prices of live animals are shown in Table 6. About 72% of the cattle sales occurred in an official market often involving male animals. The rest of the transactions (28%) occurred directly at farm level and mainly referred to female animals.

Table 6. Average sale prices of live animals per age-sex class in 70 herds in the Boji district, West Wellega, Ethiopia (2001)

Categories of animals					
	Bulls (1to 3y)	Males (>4 y)	Heifers (1 to 3y)	Females (>4 y)	All categories
Number of animals	24	88	24	65	201
Average (Birr)	258.1	504.9	311.8	484.1	445.7
Standard Deviation (Birr)	60.1	117.7	90.2	164.2	156.2
Minimum (Birr)	170	200	190	200	170
Maximum (Birr)	420	830	500	800	830
Median (Birr)	247.5	500	300	465	450

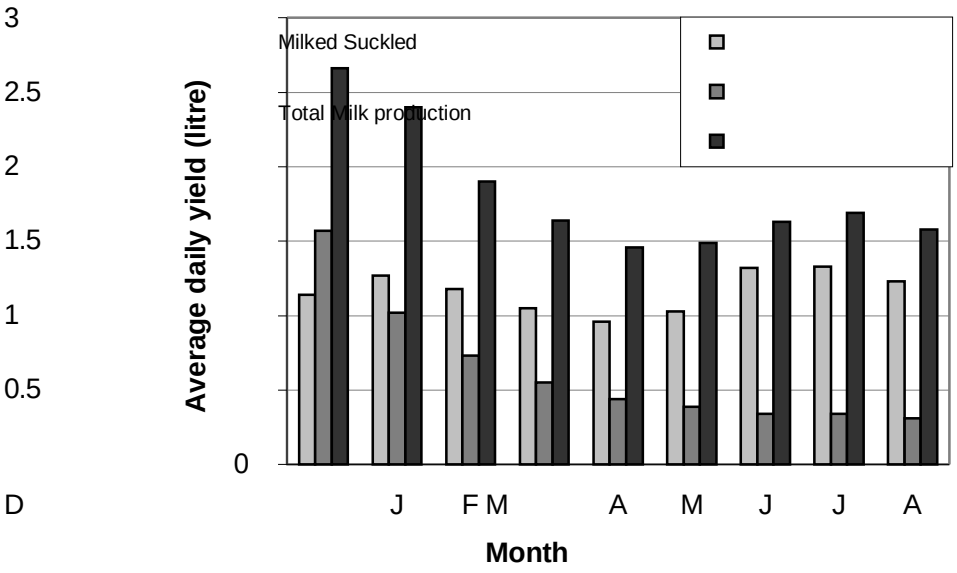

Figure 1. Average daily milk yield (milked and suckled) per month during year 2001 for a cohort of 25 cows under traditional management in Boji district, West Wellega, Ethiopia.

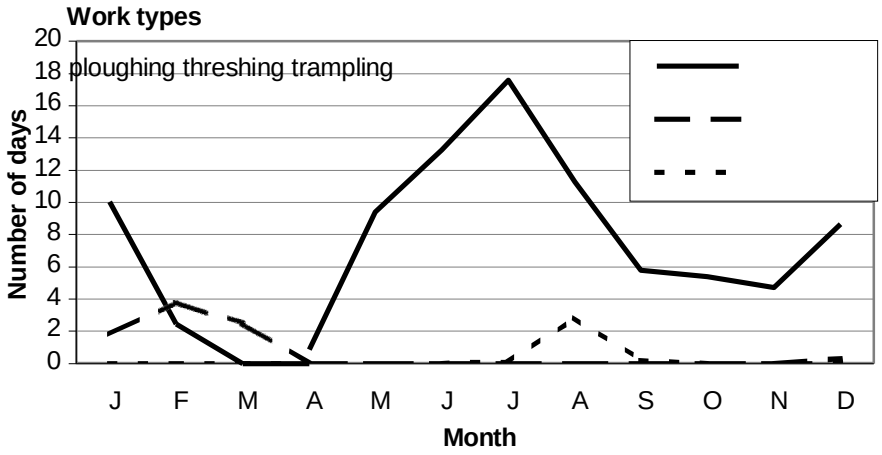

Figure 2. Monthly days and types of oxen work during year 2001 in Boji district, West Wellega, Ethiopia (from 13 herds).

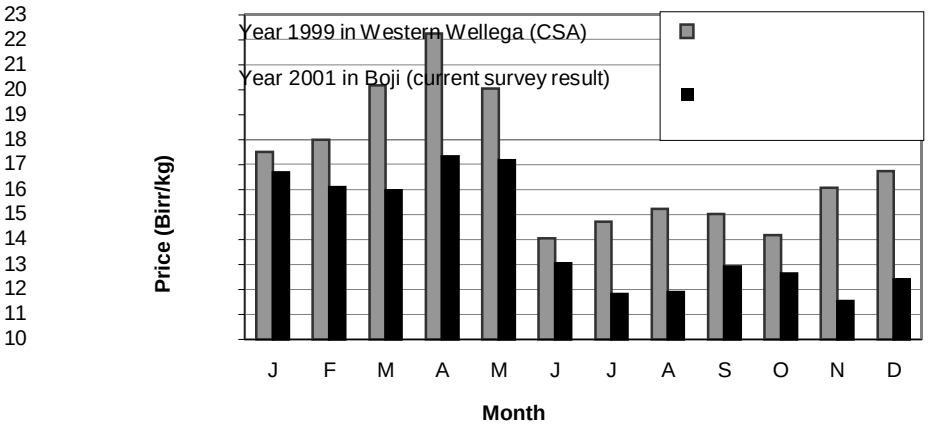

Figure 3. Comparison of the monthly average producers' price of butter in West Wellega during year 1999 (CSA, 1999a; CSA, 1999b; CSA, 2000) and the current (2001) survey findings from 18 households in Boji district, West Wellega, Ethiopia.

Discussion

On-farm studies on cow feeding in Ethiopia mostly focused on crossbreed cows (Gashaw Geda *et al*., 1991) and no quantitative data for on-farm zebu cows feeding were available for comparison. Feed inputs of cattle in Boji district are similar to the descriptions previously made for other highland areas in Ethiopia (Mukasa-Mugerwa *et al*., 1989 ; Benin *et al*., 2002), mainly composed of grazing pasture and various crop by-products. Supplementation of cattle with small quantities of crops grain and salt observed in the study area was also described in the central highlands (Goe,1987) and in the eastern highlands (Fekadu Abate and Alemu Yami, 2000). Feed shortage during the dry season was a major constraint in Boji district as described for other highland areas (Gryseels *et al*., 1989 ; Legesse Dadi *et al*., 1992), which is attributed to overstocking and overgrazing (Mohamed-Saleem and Mwendera, 1996) and lack of appropriate feeding management. Though population growth lead to a shift of grazing lands to crop cultivation in Boji, more pasture is still available to cattle as compared to the intensively cultivated areas of the central highlands where the ever declining in use of grazing lands availability forced livestock owners to heavily depend on purchased feed and crop residues (Hailu Beyene and Chilot Yirga, 1992 ; Benin *et al*., 2002).

Despite the prevalence of cattle diseases, on-farm veterinary inputs were generally low in Boji district (0.48 Birr per head of cattle per year).

Contrasting to this scenario, Baars (1998) reported an average yearly expenditure of 800 Birr per herd (average of 43 TLU/herd) in pastoral areas in eastern Ethiopia. The use of Public veterinary services was low in the study area, mainly due to their distant location away from localities where major segments of the beneficiaries live. Because of this constraint farmers usually buy veterinary products indirectly and administer by themselves to sick animals.

The genetic potential of Horro breed for milk production was reported to be poor (Alberro and Haile-Mariam, 1982). The average total lactation milk off-take obtained in the present study (369.1 litres) however was higher than the figures (<300 litres) seen in former reports based on-farm investigations or other zebu breeds in the traditional highland systems in Ethiopia (Gryseels *et al*., 1989; Mukasa-Mugerwa *et al*., 1989). On the other hand higher lactation period (10.5 months) was recorded during the study when compared with other reports (7 months around Bako (Legesse Dadi *et al*., 1992), 7 and 8 months in the central highlands (Gryseels *et al*., 1989; Mukasa-Mugerwa *et al*., 1989)). The finding from the present study is in full disagreement with the assertions of Alberro and Haile-Mariam (1982) who mentioned a short lactation period of 6 months as a specific feature of the Horro breed. Figure 1 shows clearly the effect of season on milk production and off-take. Milk off-take during the end of the dry season (March-April-May) was lower, approximately 1.0 litre/day, than during the wet season (above 1.3 litres/day). The figures obtained in the study are relatively higher than those reported for Bako (Legesse Dadi *et al*., 1992) and in 5 other traditional livestock systems in Africa (De Leeuw and Wilson, 1987). Milk performances reported for Horro breed on station, 2.4 litres/day, were higher with a lactation length of 229.8 days (Mulugeta Kebede *et al*., 1993) than the current findings from on-farm study. The difference is a reflect of the potential of Horro cattle, which is under-utilised on-farm conditions due mainly to poor management. As in many other regions of Ethiopia butter is a substantial source of cash income for households in Boji district (Duteurtre, 1998). The greatest proportion of the butter was often sold at the expense of household consumption, signifying the importance of the cash generated from this commodity to the producers.

The findings from studies on traditional cattle husbandry in sub-Saharan Africa (De Leeuw and Wilson, 1987) showed daily weight gains in the first year varying between 150 and 220 g, with greater figures in the first six-month period. The figures found in the current study were much lower (110 g, from birth to 6 months). The body weight at one week of Horro cattle from Boji was 15.2 kg, which is lower than the birth weight reported by Mukasa-Mugerwa *et al*. (1989) (21.6 kg) in the central Ethiopian highlands but comparable to that of Wilson (1985) (16.6 kg) in the agro-pastoral system in

Mali. Mulugeta Kebede (1991) in his on-station research at Bako estimated the birth weight of Horro calves to be 18.6 kg and an average daily gain of 305g from birth to 6 months of age. Poor calves' management such as low milk supply at early ages (first months) and inappropriate weaning management may explain the growth deficiency of Horro calves in Boji district. The relatively stunted growth may also be explained by the high prevalence of parasitic diseases. Low growth rates in African livestock are a major cause of low productivity, affecting the age at which reproduction commences or oxen become available for ploughing, and the weight (and age) at which animals are slaughtered (ILCA, 1990).

Few quantitative data are available concerning the work of oxen under traditional husbandry in the Ethiopian highlands. Goe (1987) reported that oxen were employed less than 50 days/year for ploughing in the central Ethiopian highlands (North Shoa), which was by far less than the 90 days observed in our study. Estimates of daily work periods were higher (5 to 6 hours in average) in North Shoa. The difference may partly be attributed to the lapse (20 years) of time between the two studies. It appeared logical that nowadays, due to farm sizes decline, farmers face a decrease in draught power availability (Benin *et al*., 2002) ; they may tend to optimise the use of animals by sharing or loan arrangement such as *goubo* contracts described in Boji (Laval *et al*., 2002). In addition, cultural and religion differences between the study sites may be regarded as a contributory factor. Goe's study was located in a Copt Christian area where there are religious holidays, between 150 and 200 days per year (Gryseels and Anderson, 1983) that farmers can not carry out field activities, which limited the yearly use of oxen. It was not the case in Boji where the protestant religion did not impose such restrictions.

The average producers' price of butter in Boji in year 2001 (14.10 Birr/kg) was lower than the price reported by CSA (1999b) in year 1999 in the same Zone (16.90 Birr/kg). Due to international coffee market fluctuations and relatively good crop harvest in high potential areas, market prices of agricultural products have shown drastic decline during the year 2001-2002 in Ethiopia.

Figure 3 clearly indicates that butter prices varied seasonally in Boji, which was similar to the figures of CSA (1999a; 1999b; 2000) in the year 1999. Prices were higher during the dry season (January to May) and decreased during the rainy season (June to October). It is merely a question of availability as a function of the seasonal milk production pattern (Figure 1). Seasonal variation in demand also exert its effect (higher in April and May because of religious ceremonies / Easter). Gryseels and Goe (1984) mentioned that oxen could be rented on a cash basis, at US$ 1.50/day/pair without manpower. Prices of live animals in Boji district were similar to

those reported by CSA for West Wellega in year 1999. They were higher than East Wellega and comparable to the national average (CSA, 1999a, 1999b, 2000).

To sum up, the demographic pressure in Ethiopian highlands and the severe reduction of available grazing lands and livestock per capita show the urgency to identify and implement policies compatible to the environment that enhance livestock productivity. This paper revealed that knowledge of local livestock practices and productivity is a preliminary necessity for addressing adequate recommendations at local level and that herd monitoring is an appropriate tool to achieve this objective.

The solution to prevailing productivity constraints must essentially encompass animal feeding during the dry season, calves and reproduction management, and animal health. Extension services could be useful means to implement envisaged recommendations. Farmers must be educated and sensitised on the availability of alternative feed resource basis, better livestock management and health care practices. Diversification of animal productions (especially sheep and chicken) may be considered as a potential option.

Recommendations that require higher investment include research on on-farm feeding and alternative feeding practices in highly populated and degraded areas and rationalisation of the veterinary services.

Acknowledgements

The authors would like to express their warm consideration and thanks to the farmers of Boji district for their continuous cooperation in providing data and willing to exchange information. The quality and accuracy of the data collected is due to the active contribution of Ambaye Yilma and Berhanu Beyene, enumerators, who are dully acknowledged.

References

Alberro, M. and Haile-Mariam, S. 1982. The indigenous cattle of Ethiopia. Part I. FAO World Animal Review 41 : 2-10.

Amare Getahun. 1978. Zonation of highlands of tropical Africa : the Ethiopian highlands. International Livestock Centre for Africa (ILCA), Addis-Ababa.

Baars, R.M.T. 1998. Costs and returns of camels, cattle and small ruminants in pastoral herds of eastern Ethiopia. Proceedings of the 6th National Conference of the Ethiopian Society for Animal Production (ESAP), May 14-15, 1998, Addis Ababa, Ethiopia, pp. 162-175.

Benin, S., Ehui, S. and Pender, J. 2002. Policies for livestock development in the Ethiopian highlands. Socio-economics and Policy Research Working Paper 41, International Livestock Research Institute (ILRI), Addis Ababa.

Cordellier, S. and Didiot, B. 1997. L'état du monde 1998: annuaire économique et géopolitique mondial. Editions La Découverte, Paris.

CSA. 1999a. Report on monthly average producers' price of agricultural products in rural areas, January 1999 - April 1999. Central Statistical Authority (CSA), Addis Ababa.

CSA. 1999b. Report on monthly and national average producers' price of agricultural products in rural areas, May 1999 - August 1999. Central Statistical Authority (CSA), Addis Ababa.

CSA. 2000. Report on monthly average producers' price of agricultural products in rural areas, September 1999 - December 1999. Central Statistical Authority (CSA), Addis Ababa.

CSA. 2001. Ethiopia Statistical Abstract 2000. Central Statistical Authority (CSA), Addis Ababa.

De Leeuw, P.N., McDermott, J.J. and Lebbie, S.H.B. 1995. Monitoring of livestock health and production in sub-Saharan Africa. Preventive Veterinary Medicine 25: 195-212.

De Leeuw, P.N. and Wilson, R.T. 1987. Comparative productivity of indigenous cattle under traditional management in Subsaharan Africa. Quarterly Journal of International Agriculture 26 (4): 377-390.

Duteurtre, G. 1998. Compétitivité prix et hors-prix sur le marché des produits laitiers d'Addis Abeba (Ethiopie). PhD thesis, University of Montpellier, France.

Faugère, O. and Faugère, B. 1986. Suivi de troupeaux et contrôle des performances individuelles des petits ruminants en milieu traditionnel africain. Aspects méthodologiques. Revue d'Elevage et de Médecine vétérinaire des Pays tropicaux 39 (1): 29-40.

Fekadu Abate and Alemu Yami. 2000. The feed resource base and feeding management of the traditional draught oxen fattening practice by smallholder farmers in eastern Hararghe highlands. In : Proceedings of the 7th National Conference of the Ethiopian Society for Animal Production (ESAP), 26-27 May, 1999, Addis Ababa, Ethiopia, pp. 179-188.

Gashaw Geda, Varvikko, T. and Khalili, H., 1991. Smallholder dairy production in northern Shoa province, central highlands of Ethiopia. 1. Assessment of feed resources in relation to the requirements on a smallholder farm. In: Varvikko, T., Development of appropriate feeding systems for dairy cattle in the Ethiopian highlands. International Livestock Centre for Africa (ILCA), Addis Ababa.

Goe, M.R. 1987. Animal traction on smallholder farms in the Ethiopian highlands. PhD thesis, Cornell University, USA.

Gryseels, G. and Anderson, F.M. 1983. Research on farm and livestock productivity in the central Ethiopian highlands : initial results, 1977-1980. ILCA Research Report 4, International Livestock Centre for Africa (ILCA), Addis Ababa.

Gryseels, G., Anderson, F., Getachew Assamenew, Abebe Misgina, Abiye Astatke and Woldeab Wolde Mariam. 1989. On-farm research to improve smallholder livestock productivity in the Ethiopian highlands. Quarterly Journal of International Agriculture 28: 365-375.

Gryseels, G. and Goe, M.R. 1984. Energy flows on smallholder farms in the Ethiopian highlands. ILCA Bulletin 17: 2-9.

Hailu Beyene and Chilot Yirga. 1992. Vertisol farming systems of North Shewa. In: Franzel, S. and Van Houten, H. (ed.), Research with farmers: Lessons from Ethiopia. CAB International. pp. 79-96.

ILCA. 1990. Livestock systems research manual. Working paper 1, International Livestock Centre for Africa (ILCA), Addis Ababa.

ILRI. 2000. Handbook of livestock statistics for developing countries. Socio-economics and Policy Research Working Paper 26, International Livestock Research Institute (ILRI), Nairobi.

Laval, G., Bonnet, P., Freguin, S., Waktole Terfa and Lesnoff, M. 2002. The mixed production system and livestock practices in the Boji district (West Wellega Zone) of Ethiopia. Agricultural Systems, submitted.

Legesse Dadi, Gemechu Gedeno, Tesfaye Kumsa and Getahun Degu. 1992. The farming system of the Bako area. In: Franzel, S. and Van Houten, H. (ed.), Research with farmers: Lessons from Ethiopia. CAB International.
pp. 43-59.

Lee, E. T. 1992. Statistical methods for survival data analysis. Wiley, New York.

Lesnoff, M., Diedhiou, M. and Laval, G. 2002. The demographic parameters of cattle livestock (Horro type) in Boji District in Ethiopia (West Wellega Zone). Revue d'Elevage et de Médecine Vétérinaire des Pays tropicaux, submitted.

Mohamed-Saleem, M.A. and Mwendera, E.J. 1996. Land degradation and intensified livestock and crop production in the Ethiopian highlands. Conference handbook and volume of abstracts of the All Africa Conference on animal agriculture (South African Society of Animal Science, Irene), 1-4 April, 1996, Pretoria, South Africa. pp. 3.2.12.

Mukasa-Mugerwa, E., Ephraim Bekele and Taddese Tessema. 1989. Type and productivity of indigenous cattle in Central Ethiopia. Tropical Animal Health and Production 21: 120.

Mulugeta Kebede. 1991. Birth weight, early mortality, and body development in indigenous Horro cattle. Proceedings of the Third Livestock Improvement Conference of the Institute of Agricultural Research, 24-26 May, 1989, Addis Ababa, Ethiopia, pp.112-115.

Mulugeta Kebede, Tesfaye Kumsa and Gebre-Egziabher Gebre Yohannes. 1993. Some productive and reproductive performances of Horro cattle at Bako Research Center. In: IAR/NLIC Proceedings 4. Institute of Agricultural Research (IAR), Addis Ababa. pp. 78-82.

SPSS Base 10.0. 1999. User's guide. Michigan, III., SPSS Inc.

Van Klink, E.G.M., Corten, J.J.F.M. and Kalokoni, D.M. 1996. Herd monitoring in traditional cattle husbandry as a tool for productivity research and livestock development. Tropical Animal Health and Production 28: 273-279.

Wilson, R.T. 1985. Livestock production in Central Mali: long term studies on cattle and small ruminants in the agro-pastoral system. ILCA Research Report 14, International Livestock Centre for Africa (ILCA), Addis Ababa.

Zinash Sileshi, Aschalew Tsegahun, Alemu Yami and Azage Tegegne. 2001. Status of livestock research and development in the highland of Ethiopia. Proceedings of two stakeholder workshops on Wheat and weeds: food and feed. CIMMYT, 10-11 October, 2000, Mexico City, Mexico, pp. 227-250.