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Performance of Crossbred Dairy Cows Under Small and Medium Scale Farmers' Management in and Around Shashamane City, Southern Ethiopia

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ABSTRACT

The study was conducted in and around Shashamane city to assess feed intake and productive performance of crossbred dairy cows during early lactation under farmers' management. A total of 120 dairy farmers were selected for the study. Structured questionnaire, secondary data sources and field observations were employed to generate data. A total of 48 animals in early lactation and parity from 2 to 6 were used for monitoring study for the period of 90 days. Significant differences were observed in daily intakes of DM, crude protein and ME ($P<0.001$) between production sub-systems and herd size groups. Daily milk yield was also significantly different ($P<0.05$) between production sub-systems and herd size groups ($P<0.01$). Therefore, from the current study it was concluded that productivity of animals on both production sub-systems and farm scale was below their expected genetic potential. Hence, large variation between production sub-systems and farm scale groups showed the opportunities for further improvement with strategic supplementation of energy and protein rich feeds.

Keywords: urban peri-urban dairy, farm scales, nutrient intake, productivity, Shashamane.

INTRODUCTION

The current population of Ethiopia is about 90 million, which is growing at an annual rate of 3.2% (World Fact Book, 2013). Pressure on the agricultural sector is constantly increasing**.** It is expected that an increase in population growth demands a better economic performance than in the past to prevent poverty, create employment and ensure food security (CSA, 2011; MoARD,

2007). The demand for animal products is expected to increase considerably (Mohammed *et al*., 2004). Ethiopia is believed to have the largest livestock population in Africa, of which the contribution of cattle is significant. Cattle population of the country is estimated to be about 52.13 million (CSA, 2012). This estimate excludes cattle population in three zones of Afar and six zones of Somali regions. Dairy production is an important component of livestock production in Ethiopia. It is practiced in almost all parts of the country across all agro-ecological set up. Particularly the mixed crop–livestock system in the highlands offers the best opportunity for dairy development and can support crossbred and pure dairy cattle breeds. However, despite the large livestock resource base and an ecological setting suitable for dairy production, the country is not yet self sufficient in milk production. In Shashamane milkshed, market oriented small and medium scale farms in the urban and peri-urban centers are the two categories of milk production systems (Sintayehu *et al*, 2008). These farms rely on crossbred and exotic cattle breeds under intensive and semi-intensive management with production goal of cash income. Previous study conducted in the area focused mainly on characterization of dairy production, marketing and processing in Shashamane Dilla area (Sintayehu *et al.*, 2008). Whereas the productive performance of crossbred dairy cows, whose contribution has a great role to urban and peri-urban milk production has not been studied. Therefore, it is important to evaluate the current milk production status of small and medium scale dairy farms operating under urban and peri-urban levels in devising appropriate development interventions. This study was therefore, aimed to look into the performance of crossbred dairy cattle with respect to farmers' management in urban and peri-urban areas of Shashamane milkshed.

MATERIALS AND METHODS

The study was conducted on private urban and peri-urban dairy farms in and around Shashamane city. The area is characterized with different altitude ranges of 1900 and 2200 meters above sea level and average minimum and maximum temperature of 12 and 27°C respectively.

Sampling methods

A preliminary visit was conducted in the study area to get general picture of the study sites and to identify the target farms. Two dairy production sub-systems and two herd size groups were identified in the area. Each production sub-system was further stratified into two based on herd size: small holders (farms with <4 cows) and medium level (farms with 4-10 cows); Ike (2002). For this study a total of 120 dairy farms, 60 from each production sub-system were purposively selected. Sixteen farms having crossbred dairy cows, parity ranges between 2 and 6 and were at their last months of pregnancy were selected for the monitoring study. Accordingly, 8 farms from each small and medium scale farms (8 from each urban and peri-urban farm) were selected for the study. A total of 48 dairy cows, two from each small scale and four from each medium farms, were selected for monitoring study. Monitoring study was conducted from October to December 2012.

Data collection procedures

A structured questionnaire was prepared and pre-tested for its applicability before its administration. Monitoring of the utilization of feed resources and milk yield was carried out once a week for the period of 90 days. The amount and type of feed offered to individual cows

was weighed and recorded for each monitoring date using portable spring balance. It was observed that most farms provide concentrates and roughages after wetting it with water or *atela*. Under such conditions, the quantity of feed to be mixed was weighed prior to wetting and divided to the number of dairy cows. Accordingly the refusal of any feed type offered was weighed and recorded. The amount of metabolizable energy (ME) and nitrogen intake over a given period of time was estimated by multiplying the nutrient content of the feed (per kg dry matter) by the daily dry matter intake of the respective feed. Feed utilization for the non collection period was calculated from the average values of the preceding and current measurements. Data were collected by literate individuals. Data collection from the selected dairy cows was started one week after calving. Heart girth of milking cows used for monitoring study was measured in the morning before feed was offered at two weeks interval using a plastic measuring tape for the period of 90 days. Body weight of the cow was estimated from heart girth measurement using the regression equation developed by ILRI as cited by Yoseph (1999).

$Y = -423.405235 + 4.833697x$ ($R2 = 0.86$; $CV = 10\%$).

Where, Y= Estimated body weight, Kg (weight range for prediction was 200-500 kg)

x= Heart girth, cm.

Statistical Analysis

General Linear Model (GLM) procedure of SAS (2004) was used for analyzing data collected during monitoring. Mean comparison was done using the Least Significant Difference (LSD) for parameters with significant difference. Differences were considered statistically significant at 5% level of significant. The model used to analyze the effects of farm scale and parity classes on milk yield, reproductive traits and nutrient intake was:

$Yij = \mu + Ai + Bj + eij$

Where,

Yij = response variables (nutrients intake, productive and reproductive performance of dairy cows)

μ = overall mean

Ai = fixed effect of ith production sub-system (i= 1, 2)

Bj = fixed effect of jth herd size (j= 1, 2)

eij = residual effect.

RESULTS AND DISCUSSION

Feeds and nutrient intake

Basal and supplement dry matter intake was significantly ($P<0.001$) varied between production sub-systems and herd size groups (Table 1). Basal feeds contributed 30.4% and 40.4% of the DM intake in urban and peri-urban farms, respectively. Higher roughage DM intake in peri-urban farms may be due to less availability of concentrate feeds in the area compared to urban areas. The result of the current study was not in agreement with 50% and 36% contribution of basal feed to the total dry matter intake in intra-urban and secondary town dairy farms, respectively, in Addis Ababa milk shed (Yoseph, 1999). The result of the current study was comparable with 9.6kg and 11.4kg daily DM intake by crossbred cows in small and medium scale farms, respectively, in Sebeta Awas area (Dereje, 2012). Basal, supplement and total CP intakes significantly varied ($P<0.001$) between production sub-systems and farm scales. The difference might be related to feeding practices used in different farms. Higher proportion of small scale farms (35%) use *Atela* as protein supplement compared to medium scale (21%) farms. The

energy intake of dairy cows in urban farms was significantly (P<0.01) higher than peri-urban farms. Basal feeds contributed about 24% and 34% of the total energy intake in urban and peri-urban farms, respectively. The difference was related to higher intake of concentrated DM in urban farms than peri-urban farms. Energy intake was also significantly different (P<0.001) between farm scales. The result of the current study was lower than 99.6 MJ ME/cow/day for crossbred cows in small scale farms, but higher than 94.1 MJ ME/cow/day for medium scale farms in and around Dire Dawa city (Fayo, 2006). Higher nutrient intake reported in medium sized farms compared to the small sized dairy farms might be due to generation of larger income from milk sale in medium sized farms which encouraged farm owners to purchase more feed compared to small sized farms.

Milk yield and composition

There was significant difference in daily milk yield between production sub-systems (P<0.05) and herd size groups (P<0.01) (Table 2 and 3). The difference could be attributed to higher nutrient intake originated from concentrate feeds in urban farms compared to the peri-urban dairy farms (Table 2). Mean daily milk yield in the current report was higher than 9.0±3.9 liters/day in urban and 9.0±4.0 liters/day in peri-urban farms reported for crossbred dairy cows in Northern Ethiopia (Gebrekidan *et al*., 2012).

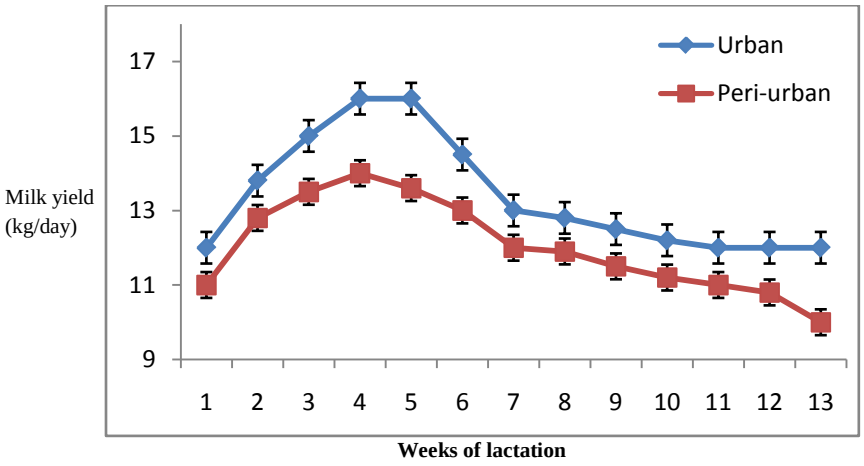

Figure 1. Mean daily milk yield of cows in two different production sub-systems during 13 weeks of lactation.

Cows in the urban farms were showed fast increase of milk yield up to the peak at week 4 and 5, but continuously declined there after (Figure 1). The trend of increase in cows from peri-urban farms was relatively slow and short. The peak yield was attained at week 4 and was declined thereafter. Dairy cows in medium scale farms achieve peak milk yield at week 4 and decline thereafter, while those in small scale farms achieve peak yield at week 5. There was significant difference in fat percentage (P<0.05) between the production sub-systems and herd size groups. The result of the current study was comparable with 4.25% fat, 2.89% protein, 13.2% total solid and 8.53% solid not fat reported for crossbred cows in urban and peri-urban production system (Dereje, 2012). The difference might be attributed to the variation in the level of nutrition in different farms. Fat and protein percent in the current study fall within the acceptable range of 2.5 to 6.0% and between 2.9 to 5.0% for fat and protein, respectively (O'Connor, 1994).

Table 1. Mean (±SE) daily feed intake by dairy cows in urban and peri-urban dairy production systems in Shashamane milk shed (n=48)

Parameters	Dry matter intake (kg DM/day)			Crude protein intake (g/day)			Energy intake (MJ/day)		
	Total	Roughage	Concentrate	Total	Roughage	Concentrate	Total	Roughage	Concentrate
Overall	10.8±0.3	3.8±0.1	7.0±0.2	1500.6±54.9	243±6.8	1257.5±51.8	98.7±2.7	28.2±0.86	70.5±2.3
Production system	NS	***	***	***	***	***	**	***	***
Urban (n=24)	11.2±0.4	3.4±0.1^{b}	7.8±0.3^{a}	1679±57.9^{a}	223.8±7.7^{b}	1454.9±50^{a}	105±3.6^{a}	25.2±0.9^{b}	80±2.8^{a}
Peri-urban (n=24)	10.4±0.4	4.2±0.16^{a}	6.2±0.2^{b}	1322±78.8^{b}	263±9.9^{a}	1060±71.3^{b}	92.2±3.6^{b}	31.3±0.8^{a}	60.9±2.4^{b}
Herd size	***	***	***	***	***	***	***	**	***
Small (n= 16)	8.9±0.3^{b}	3.0±0.09^{b}	5.8±0.3^{b}	1132±88.5^{b}	201±5.8^{b}	931±88.5^{b}	81.5±3.4^{b}	23.2±0.7^{b}	58.3±3.2^{a}
Medium (n=32)	11.7±0.3^{a}	4.1±0.1^{a}	7.6±0.2^{a}	1685±40.9^{a}	264±7.5^{a}	1421±40.5^{a}	107±2.6^{a}	30.5±0.9^{a}	77±2.4^{b}

n= number of dairy cows monitored; ^{ab} means in the same column with different subscript letters were significantly different;
NS = non significant; **= P<0.01; ***=P<0.001; DM= dry matter, MJ= mega joule

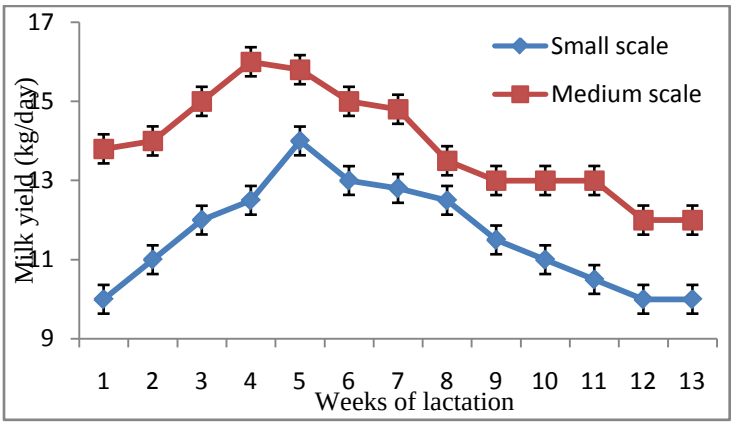

Figure 2. Mean daily milk yield of dairy cows in two different farm scales during 13 weeks of lactation.

Table 2. Mean daily milk yield and composition under urban and peri-urban farms.

Variables	Production subsystems		
	Urban	Peri-urban	Significance
Number of cows	24	24	
Average milk yield (kg/cow/day)	13.4±0.34	12.2±0.33	*
Milk composition (%)			
Fat	3.92±0.08	4.13±0.09	*
Protein	2.91±0.0	2.87±0.01	NS
Total solid	12±0.08	12.2±0.15	NS
Solid not fat	8.1±0.1	8.3±0.1	NS

*= P<0.05; NS= not significant

Table 3. Mean daily milk yield and composition under small and medium farms.

Variables	Production sub-systems		
	Small	Medium	P
Number of cows	16	32	
Average milk yield (kg/cow/day)	11.5±0.35	13.8±0.25	***
Milk composition (%)			
Fat	4.3±0.08	3.77±0.07	*
Protein	2.91±0.0	2.89±0.0	NS
Total solid	12.35±0.15	11.94±0.1	*
Solid not fat	8.06±0.12	8.16±0.09	NS

*= P<0.05, ***= P<0.00; NS= not significant

CONCLUSION

The productivity of animals on both production sub-systems and farm scales was below their expected genetic potential, where in peri-urban and small scale farm was critically low as compared to some parts of the tropics. The amount of crude protein (gram/day/head) consumed was above the requirement for the observed actual milk output except in small scale farms. However, the amount of ME (MJ/day/head) consumed was below the requirement for the observed actual milk output in both production sub-systems and farm scales.

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