A survey on livestock and milk production characteristics of peri-urban agropastoral dairying in Ghana

S. A. OKANTAH, F. Y. OBESE, E. O. K. ODDOYE, P. GYAWU & Y. ASANTE

(S. A. O., F. Y. O. & E. O. K. O. : Animal Research Institute, Council for Scientific and Industrial Research, P. O. Box 20, Achimota, Ghana; P. G.: Department of Animal Science, Kwame Nkrumah University of Science and Technology, Kumasi, Ghana; Y. A.: Department of Economics, University of Ghana, Legon, Ghana)

SUMMARY

A survey was conducted in five districts on the Accra plains to characterize the peri-urban dairy production system. Results from the survey indicated that farmers were keeping cattle, sheep, goats, and poultry (Guinea fowl, turkey, chicken, and duck), cattle being the only species milked. The mean flock size was 73.6 TLU with a coefficient of variation of 103 per cent. The average cattle herd size was 133. Farmers made limited use of agro-industrial by-products. Cultivation of pastures, improved fodder, and multipurpose trees was non-existent, and neither was any system of cut and carry practised. The use of concentrate and protein supplementation was also negligible. The mean length of the dry season was 5.2 ± 0.7 months. Offtake was low at 8.9 per cent per annum. Replacement and calving rates were 0.7 and 0.67, respectively. The mean age at first calving and calving interval were 36 and 14.4 months, respectively. The mean lactation length was 8.5 months. There were no crossbreds of the type 'exotic × local'. The Sanga was the predominant breed of cattle and constituted over 76 per cent of cattle kept on the Accra plains. Feeding of calves was by suckling residual milk from dams after partial milking. Calves were allowed to suckle until the cow was nearly dry, leading to a long mean calf weaning age of 8.4 months. Cows were milked once daily usually in the mornings. The mean daily partial milk yield per cow was 1.55 ± 0.22 *l*. Mean partial annual milk yield per farm was 10,040 ± 2952 *l*. It was concluded that the system required substantial transfer of improved technologies to increase milk production.

RÉSUMÉ

OKANTAH, S. A., OBESE, F. Y., ODDOYE, E. O. K., GYAWU, P. & ASANTE, Y.: *Une enquête sur les caractéristiques de la production de bétail et de lait de la laiterie agropastorale péri-urbaine au Ghana.* Une enquête était faite en cinq districts sur les plaines d'Accra pour caractériser le systéme de production laitière péri-urbaine. Les résultats de l'enquête indiquent que les éleveurs élevaient les bovins, les moutons, les chévres et les volailles (la pintade, les dindons, les poulets et les canards). Les bovins, étant les seuls espéces traites. Le nombre moyen du troupeau était 73.6 TLU avec un coefficient de variation de 103 pour cent. Le nombre moyen de trouspeau des bovins était 133. Les éleveurs faisaient usage limité des sous-produits agro-industriels. La cultivation de pâtures, de fourrages et d' arbres polyvalents étaient non existants, d'ailleurs il n'y avait aucun système de couper-et-porter pratiqué. L'utilisation de concentré et de protéine supplémentaire était également négligeable. La durée moyenne de la saison séche était 5.2 ± 0.7 mois. Sevrage était faible à 8.9 pour cent par an. La proportion de remplacement et de vêlage étaient respectivement 0.7 et 0.67. L' âge moyen à première vêlage et l'intervale de vêlage etaient respectivement 36 et 14.4 mois. La durée de lactation moyenne était 8.5 mois. Il n'y avaient pas de métis du type 'extotique × locale'. Le sanga était l'espèce de bovin prédominant et constituait plus de 76 pour cent de bovin gardé sur les plaines d'Accra. L'alimentation des veaux était par l'allaitement de lait résiduel de méres après la traite partielle. Les veaux étaient permis d' allaiter jusqu' à ce que la vache était presque sèche menant à un long âge moyen de severage de veau de 8.4 mois. Les vaches étaient traites une fois par jour habituellement dans les matinées. Le moyen du rendement quotidien partiel de lait par vache était 1.55 ± 0.22 litres. Le moyen du

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rendement partiel annuel lait par champ était 10,040 ± 2,952 litres. La conclusion était tirée que le système exigeait le transfert substantiel des technologies améliorées pour augmenter la production de lait.

Introduction

The demand for milk from smallholder peri-urban dairy farms on the Accra plains has been high in recent years. Production is based on cattle of varying composition of mainly indigenous origin. Okantah (1990a, 1992) indicated that large quantities of milk may be produced from the several thousands of low-yielding cattle in this system. Nutrition and management are important factors affecting the reproductive performance of cattle, including milk production. However, scanty information is available on the feeding, management, and reproductive performance of these animals used for milk production on the Accra plains (Okantah & Gyawu, 1993). The Government of Ghana has set up a Pilot Milk Collection Project on the Accra plains to stimulate smallholder peri-urban milk development. Information on these production parameters will help evolve strategies for increased and sustainable milk production.

Smallholders dominate milk production in Tanzania, Ethiopia, and Malawi (Ngigwana, 1992; O'Connor, 1992; Nankumba & Mangisoni, 1992). With the proper understanding, the system could provide Ghana self-sufficiency in milk production as it is for several sub-Saharan African countries.

The objectives of this study were therefore as follows:

1. to evaluate the feeding, management, and productivity of cattle used for milk production on the Accra plains;
2. to identify constraints to the development of peri-urban dairying in Ghana; and
3. to recommend policies that will improve/increase domestic milk production and thereby reduce reliance on imported milk and dairy products.

Materials and methods

A questionnaire, developed by the Inter-national Livestock Research Institute (ILRI) and modified to capture major characteristics of milk production in smallholder herds on the Accra plains, was administered in five districts. Selection of districts was based on distance from Accra. Table 1 shows the five selected districts and their capitals.

In each district, four villages with high cattle populations were selected with the help of the District Veterinary Officer. The survey was designed to sample six farms in each of the four villages within the five districts, totalling 120 farms in all (i.e. $5 \times 6 \times 4$). In the actual survey, a total of 107 farms was sampled.

The survey was undertaken between April and August, 1995. The questionaires were administered to the farm owners or herd managers through

TABLE 1

Districts Sampled During the Survey

Distance from Accra (km)	*Name of district*	*District capital (km from Accra)*	*No. of farm owners/ herdsmen interviewed*	*Percentage of total*
0 - 49	Ga Rural	Amasaman (20)	17	16.0
0 - 49	Tema	Tema (25)	21	19.6
0 - 49	Dangbe West	Dodowa (45)	24	22.4
50 - 100	Awutu -Effutu Senya	Winneba (50)	24	22.4
> 100	North - Tongu	Juapong (110)	21	19.6
			107	100.0

interpreters. Data on reproduction and milk yield were collected on cows with at least two parturitions. Data from the field administration of the questionnaire were coded by using a format supplied by ILRI and analyzed according to the Statistical Analysis System Institute (SAS, 1987) software. Associations were tested with χ^2 statistic for significance. Socio-cultural attributes of herd managers that could influence their management style, such as the district in which they lived, ethnicity and educational background, were tested for effects on response variables. District and ethnicity had important effects and, therefore, were the only attributes included in this study (Okantah *et al.*, 1995).

Results

Livestock inventory

The species of livestock found on farms were cattle, sheep, goats, and various types of poultry (Guinea fowl, turkey, chicken, and duck). However, cattle was the only species milked in all the farms covered by the survey. The mean flock size was 73.6 ± 76.1 TLU (Table 2) with a CV of 103 per cent.

Offtake was not significantly ($P>0.05$) affected by variation in districts (Table 2). A low mean offtake value of 8.9 per cent with a high CV of 87 per cent was obtained in this study.

The structure of the mean cattle herd in the various districts (Table 3) indicated that most animals in the herd were cows, followed by calves with bulls being the least. Farmers in the Tema District kept the highest number of cows, calves, heifers, and bullocks per farmer, while farmers in the Ga Rural District kept the highest number of bulls and young bulls per farmer.

TABLE 2

Means for Livestock Inventory

		TLU		*Offtake (%)*	
Class	*Level*	*Mean*	*SE*	*Mean*	*SE*
Ψ Overall mean		73.6	76.1	8.9	8.1
District	Awutu	97.2	20.3	16.6	3.1
	Dangbe West	52.0	19.7	12.1	2.9
	Ga Rural	65.4	22.0	12.1	3.6
	North Tongu	62.3	27.1	8.9	4.0
	Tema	115.3	24.6	9.9	3.7

Ψ Unadjusted overall mean ± standard deviation
Awutu = Awutu-Effutu-Senya

Livestock feeding

The system was agropastoral, and livestock feeding practices were similar for all herds. There was no separate feeding management for dairy cows, and cattle grazed all the year round on communal lands. Pastures/improved fodder and multipurpose trees were not cultivated, and neither was any system of cut and carry practised. The use of concentrate and protein supplementation was negligible. Although agro-industrial by-products were available in the urban centres, their use was very limited. The survey found only two farmers in the Dangbe West District who fed wheatbran to their calves during the dry season.

The mean length of the dry season was 5.2 ± 0.7 months with a CV of 14.2 per cent (Table 4). There was a significant ($P<0.05$) variation in the

TABLE 3

Mean Cattle Herd Structure

District	*Cows*	*Bulls*	*Bullocks*	*Heifers*	*Young bulls*	*Calves*	*Total herd*
Overall mean	61	3	6	22	9	32	133
Awutu-Effutu-Senya	58	3	7	23	12	31	134
Dangbe West	45	2	2	15	6	24	94
Ga Rural	61	4	4	25	13	36	143
North Tongu	57	3	4	18	8	26	116
Tema	82	3	11	30	5	42	173

TABLE 4

Mean Length of Dry Season and Period of Feeding Crop Residues (months) by District

Class	Level	Dry season		Crop residue feeding	
		Mean	*SE*	*Mean*	*SE*
Ψ Overall mean		5.2	±0.7	2.2	±0.5
District	Awutu	4.7	0.20c	2.1	0.6ab
	Dangbe West	5.6	0.20a	2.3	0.2a
	Ga Rural	5.6	0.56a	2.3	0.6a
	North Tongu	3.8	0.76d	1.4	0.4b
	Tema	5.2	0.46b	2.8	0.2a

Ψ Unadjusted overall mean ± standard deviation
Means in the same column with different postscripts (a,b,c,d) are significantly ($P<0.05$) different
Awutu = Awutu-Effutu-Senya

length of the dry season between districts. The North Tongu District with 3.8 months of dry period was the wettest, followed by Awutu-Effutu-Senya with 4.7 months. The other three districts were relatively dry. The number of months cattle grazed crop residues was also significantly ($P<0.05$) affected by variation in district. The regression of the number of months cattle grazed crop residues on the length of the dry season was low and insignificant (0.2 at $P>0.05$). Herds in North Tongu District had limited grazing period on crop residues.

Livestock reproduction

Replacement and calving rates were not significantly ($P>0.05$) affected by district and ethnic group (Table 5). Mean replacement and calving rates were high, 0.70 and 0.67, respectively.

Calving interval was not significantly ($P>0.05$) affected by district and ethnic group. Mean calving interval was 14.4 ± 1.1 months. The calving intervals estimated from the questionnaires were inconsistent with theoretical expectations based on the calving rate. The expected intervals were therefore computed from the field calving rates. This underscores the need for proper record keeping in the herds, as herd manager's memory alone cannot provide true and reliable parameters of reproductive efficiency. Mean expected calving interval was 18.2 months. Heifers first calved at about 36 months of age.

Lactation length was not significantly ($P>0.05$) affected by district and ethnic group (Table 5). Mean lactation length was 8.5 ± 0.34 months. Sex

TABLE 5

Means for Replacement Rate, Calving Rate, Calving Interval, Lactation Length and Sex Ratio by Different Classification

Class	Level	Replacement rate	Calving rate (months)	Calving interval (months)	Expected calving interval (months)	Lactation length (months)	Sex ratio
Ψ Overall mean		0.70	0.67	14.4	18.2	8.50	0.35
District	Awutu	0.70	0.67	14.6	18.2	9.05	0.39
	Dangbe West	0.37	0.71	14.1	17.1	8.39	0.32
	Ga Rural	0.43	0.72	16.5	16.9	8.46	0.36
	North Tongu	0.51	0.68	12.8	17.9	8.87	0.33
	Tema	0.51	0.65	13.3	18.7	8.98	0.32
Ethnic group							
	Fulani	0.32	0.67	14.6	18.2	8.12	0.38
	Ga	0.73	0.68	14.8	17.9	8.99	0.27
	Ewe	0.66	0.61	14.3	19.9	8.99	0.33
	Others	0.32	0.79	13.3	15.4	8.91	0.38
Average	SE	0.22	0.09	1.1	-	0.34	0.04

Ψ Unadjusted overall mean ± standard deviation
Awutu = Awutu-Effutu-Senya

ratio was also not significantly ($P>0.05$) affected by ethnic group or district (Table 5). Mean sex ratio was 0.35 ± 0.04.

There was no significant association between district and the purchase of replacement cows (Table 6). With the exception of Dangbe West where about 58 per cent did not purchase replacement cows, in the other districts this was over 70 per cent.

Similarly, there was no significant association between ethnicity and the purchase of replacement cows. On the average, 76.7 per cent of herders across ethnic groups did not purchase replacement cows.

TABLE 6

Percentage of Farmers Purchasing Cows by District

District	*Cow purchase (%)*	
	Yes	*No*
Awutu-Effutu-Senya	29	71
Dangbe West	42	58
Ga Rural	18	82
North Tongu	19	81
Tema	26	74
Mean	26.8	73.2

Breeding and management

There were no crossbreds of the type "exotic × local". The predominant local breed was the Sanga. This is a cross between a humpless animal, usually the Shorthorn, and a Zebu animal. Sangas constitute over 76 per cent of cattle found on the Accra plains.

Only one type of housing was observed for cattle during the survey. Cattle and calves were housed in open kraals with no roof. Calves usually had a separate kraal to facilitate milking.

Feeding of calves was by sucking residual milk from their dams after partial milking. No bucket feeding was practised. Male calves, not selected for breeding, were usually castrated and sold off after fattening.

There was no significant relationship between district and the use of oxen or bulls for traction (Table 7). With the exception of Tema where one out of 21 farms used oxen/bulls for traction, the other farms did not use any oxen/bulls for traction. Most farms relied on the hoe and cutlass or the tractor.

TABLE 7

Percentage of Farmers Using Oxen/Bull for Traction

District	*Use of animal traction (%)*	
	Yes	*No*
Awutu-Effutu-Senya	0	100
Dangbe West	0	100
Ga Rural	0	100
North Tongu	0	100
Tema	5	95

Calf weaning and milk yield

Table 8 presents production parameters on calf weaning and milk yields. There were no important variations between districts in calf-weaning age. The mean calf-weaning age was 8.4 months.

There was a low positive but insignificant regression between the length of dry season and calf-weaning age ($b = 0.28$). Similarly, ethnicity did not significantly ($P>0.05$) affect calf-weaning

TABLE 8

Mean Age at Weaning and Estimated Partial Milk Yields

Class	*Level*	*Weaning age (months)*	*Partial milk yield*	
			Daily/cow (litres)	*Annual/herd (litres)*
		Mean	*Mean*	*Mean*
Overall mean		8.4	1.55	10040
District	Awutu	9.1	1.95	13476
	Dangbe West	8.6	1.41	10421
	Ga Rural	8.2	1.42	9600
	North Tongu	8.5	1.50	11146
	Tema	9.1	1.71	12681
Ethnic group				
	Fulani	8.0	1.45	8977
	Ga	8.7	1.91	11554
	Ewe	9.0	1.63	11562
	Others	9.0	1.41	13766
Average SE		0.4	0.22	2952

Awutu = Awutu-Effutu-Senya

age.

In general, cows were milked once daily usually in the morning. Processing of milk was based on traditional methods. There was no significant ($P>0.05$) effect due to district and ethnic group on the frequency and time of milking and the method of processing. The length of dry season and frequency of watering also had no effect on milk yield ($P>0.05$). Watering frequency was low and similar in all herds. Variations due to district and ethnic group did not significantly ($P>0.05$) affect mean daily and yearly partial milk yields (Table 8). The mean daily partial milk yield per cow was 1.55 ± 0.22 *l*, and the mean annual partial milk yield per farm was 10 040 ± 2 952 *l*.

Discussion

Livestock inventory

The mean flock size of 73 ± 76.1 TIU with a CV of 103 per cent, suggests farmers were keeping many livestock, and variability among herd sizes were high. The low offtake value indicates cattle farmers were not culling and, therefore, kept a lot of old unproductive cows in their herds.

Livestock feeding

The limited use of concentrate, protein supplementation, and agro-industrial by-products corroborated an earlier report by Oppong & Okantah (1974) who observed insufficient or no supplementary feeding, either for calves or during the dry lean season for smallholder dairy herds, on the Accra plains. The reason may be that herd owners may not see the need to buy supplementary feed especially where the herd is owned by more than one person; the herdsman may not derive any extra benefit by purchasing supplementary feed for the herd being managed, or herdsmen may be unaware there are agro-industrial by-products that can be used and where they are located. The lack of supplementary feeding may have an effect on milk production as animals are severely underfed during the dry season, leading to late puberty, delayed age at first calving, and long calving intervals, among others. The main strategy farmers used to overcome feed shortage was to graze cattle for longer periods, and over longer distances.

The low insignificant regression value of the number of months cattle grazed crop residues on the length of the dry seasons suggests inadequate integration of cattle and crop production. Although most herdsmen practise subsistence farming which would generate scanty crop residue, large quantities of crop residues are available from bigger crop farms which are usually not too far away. Farmers prefer grazing of cattle over longer distances to collecting and storing crop residue for use during the dry season.

Livestock reproduction

The high replacement rate value of 0.7 for this study implies farmers were keeping a high percentage of heifers for replacement in the herd. A high calving rate of 0.67 indicates moderate to good reproductive performance of cows in the production system.

The mean calving interval value of 18.2 months for this study was, however, higher than the mean value of 13.5 and 14.2 months reported by Osei *et al.* (1993) for a mixture of N'dama and West African Shorthorn cattle and Sanga cattle, respectively, in the humid forest zone of Ghana. The abundance of feed almost throughout the year in the humid forest zone of Ghana may account for these differences. Adequate nutrition tends to reduce the postpartum anoestrous period, leading to a reduction in calving interval. Osei *et al.* (1993) reported that supplementing a herd comprising N'dama and West African Shorthorn cattle (WASH) in the humid forest zone of Ghana with brewers' spent grains improved their reproductive performance by reducing calving to mating interval (40 days), calving to conception interval (40 days), and calving interval (36 days).

The delayed age at first calving may be due to inadequate nutrition, especially in the dry season which was identified as an important factor affecting peri-urban dairy production in the Accra

plains. Inadequate nutrition has been reported to delay the onset of sexual cycle in heifers; hence, it prolongs the age at first calving (Arthur, Noakes & Pearson, 1982; Payne, 1990). Osei *et al.* (1993) reported that age at first calving for N'dama/WASH cattle was reduced by 80 days from 1189 to 1109 when supplemented with brewers' spent grains. The effect of nutrition on ovaries is mediated through the pituitary gland (Heap, Allen & Lamming, 1963). The age at first calving observed in this study was slightly higher than the 35.2 months observed by Karikari *et al.* (1994) for N'dama cattle in the humid forest zone of Ghana. The delayed age at first calving is a constraint to milk production.

A mean sex ratio of 0.35 ± 0.17 implies a rather high percentage of males kept in the production system. The low mean value of 26.8 per cent for purchase of replacement cows indicate farmers tendency to generate their own replacement heifers and their unwillingness to sell young females.

Breeding and management

Crossbreeding with exotic cattle has been restricted to stations run by the Animal Research Institute, the University of Ghana, the University of Science and Technology, and the Amrahia Dairy Farm (Okantah, 1990b). The present level of management on agropastoral farms cannot support efficient crossbred dairy production. Since Sangas are not high-producing dairy animals, breeding is a major constraint to milk production on the Accra plains. Housing of calves in open kraals with no roof is another major constraint especially during periods of inclement weather. The marshy calf pens observed especially during the rainy season may also serve as good breeding grounds for ectoparasites and worms.

Calf weaning and milk yields

The calf is required for milk letdown. Therefore calves are kept to suckle until the cow is nearly dry. This practice leads to a long calf-weaning age of 8.4 months. This agrees with Okantah (1992) who reported calf-weaning age of about 8 months in partial milking herds.

The positive but low insignificant regression between the length of dry season and calf-weaning age (b=0.28) indicates that the length of dry season had no important effect on weaning age. The non-significant effect of ethnicity of herdsman on calf-weaning age implied that various ethnic groups were weaning calves at about the same age. The lack of use of oxen/bulls may be attributed to insufficient cropping and hence land tillage, limiting the need for animal traction.

The processing of milk based on traditional methods observed in this study, agreed with an earlier report (Okantah, 1990a).

The low partial mean daily milk yield per cow and low partial mean annual milk yield per farm underscore the fact that Sangas used in the production system were not high-producing dairy animals. Nevertheless, the many cows used in the system implied substantial aggregate production of milk in the system.

In conclusion, it is important that cattle farmers be encouraged to cull and replace old unproductive cows to improve productivity. A viable dairy production enterprise depends on adequate provision of farm inputs such as feed and drugs, among others; and educating farmers to sell some of their cattle to purchase such inputs cannot be overemphasized. Nutrition is very important, as it affects dairy production. The provision of adequate nutrition is necessary to improve reproductive performance of cattle and hence increase in milk yields. As such encouraging farmers to supplement their cattle with agro-industrial by-products, crop residues, and multipurpose tree legumes especially in the dry season would be an important means for improving the dairy industry.

Proper housing for calves to eliminate predisposition to respiratory diseases as well as to ectoparasite and endoparasite infestation is a necessity, as this would improve the survivability of calves. There is the urgent need for livestock extension officers to visit farmers to impart new

and efficient methods of livestock production as well as to help address farmers' problems. There is, therefore, the need for substantial interventions through adaptation and transfer of improved technologies in nutrition, husbandry, and health to improve milk production in the system.

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