

Constraints to ruminant production in East Mamprusi District of Ghana

P. K. TURKSON & J. NAANDAM

Department of Animal Science, School of Agriculture, University of Cape Coast, Cape Coast, Ghana

ABSTRACT

A study was designed to identify species-specific constraints to ruminant production as perceived by animal owners in East Mamprusi District. The hypothesis was that the constraints to production as perceived by sheep, goat and cattle farmers were sufficiently different to warrant species-specific strategies being recommended. A total of 516 ruminant owners were chosen from the 10 agricultural zones of the district using a multistage sampling technique. They were interviewed using a questionnaire with open-ended and closed questions. A total of 496 completed questionnaires were acceptable, comprising 32.9 per cent sheep owners, 36.7 per cent goat owners, and 30.4 per cent cattle owners. The response rate was 96 per cent. The study showed that the background or perceptions of sheep, goat and cattle owners differed significantly ($P < 0.05$) in major occupation, average numbers of animals kept, length of experience, management systems, and in reasons for keeping a particular species to rear. Most respondents considered diseases to be the primary problem constraining production, irrespective of the species kept, followed by housing, feeding, or lack of knowledge on management. Their perceptions on most beneficial assistance were not significantly different. It was, therefore, concluded that species-specific solutions were unnecessary when addressing issues concerning constraints to ruminant production identified in this study in East Mamprusi District of Ghana.

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RÉSUMÉ

TURKSON, P. K. & NAANDAM, J.: *Contraintes à l'élevage de ruminant dans le district de Mamprusi de l'Est du Ghana.* Une étude conçue pour identifier les contraintes qui sont spécifiques à certaines espèces de l'élevage de ruminant comme perçu par les propriétaires des animaux dans le district de Mamprusi de l'est. L'hypothèse était que les contraintes à l'élevage comme perçu par les éleveurs de mouton, de chèvre et de bétail étaient assez différentes pour justifier des recommandations de stratégies qui étaient spécifiques à certaines espèces. Un total de 516 propriétaires de ruminant étaient choisis des 10 zones agricoles du district en utilisant la technique d'échantillonnage multiscène. Ils ont passé un entretien en utilisant un questionnaire avec des questions ouvertes et fermées. Un total de 496 questionnaires remplis étaient acceptables et comprenaient 32.9% propriétaires de moutons, 36.7% propriétaires de chèvres et 30.4% propriétaires de bétail. La proportion de réponse était 96%. L'étude montrait que l'horizon ou les perceptions des propriétaires de mouton, de chèvre et de bétail se distinguaient considérablement dans le domaine d'occupation majeure, de nombre moyen d'animaux élevés, de durée d'expérience, de conduite de l'élevage et de quelques raisons pour lesquelles quelques espèces en particulier sont choisies et élevées. La majorité de personnes interrogées considéraient les maladies comme leurs problèmes fondamentaux, contraignant l'élevage, indépendamment de l'espèce élevée, suivies par le problème de parc ou d'enclos, d'alimentation et de manque de connaissance de la conduite de l'élevage. Leurs perceptions de l'aide la plus bénéfique étaient considérablement différentes. La conclusion était donc tirée que les solutions qui sont spécifiques à certaines espèces n'étaient pas nécessaires en abordant le problème concernant les contraintes à l'élevage de ruminant énumérées dans cette étude dans le district de Mamprusi de l'Est du Ghana.

Introduction

Ruminants are important to the smallholder farmer in rural areas. Winrock International (1983) noted that livestock are a source of food supplementation or income or both to rural farmers.

According to Akyeampong (1994), almost all ruminant livestock production in Ghana is based on a low-cost, low-output traditional system using natural pastures in the open range and crop residues from the farm. Consequently, increases in productivity are difficult. However, the government of Ghana aims to increase meat and milk production in the country and reduce dependence on imports of livestock and livestock products. Therefore, it is necessary to identify the constraints to ruminant production.

The major constraints reported for ruminant production in the tropics include year-round feed supply and animal health, together with institutional, natural resource, land use and policy issues (Winrock International, 1992). Gyening (1986a) reported that the major constraints to livestock production in Ghana were lack of adequate nutrition and proper management, lack of clearly defined breeding objectives and programmes, absence of good breeding stock, ineffective extension and co-ordination services, and constant threat of diseases. These constraints are general and may or may not apply to all ruminant species. Moreover, these constraints had often been identified from the perspective of researchers without involving the stakeholders—the livestock farmers.

This study was, therefore, designed to identify species-specific constraints to ruminant production as perceived by the farmers. The hypothesis was that the constraints to production as perceived by sheep, goat and cattle farmers were sufficiently different to warrant recommending species-specific strategies rather than generic ones. The aim was to find out whether there were species-specific constraints to ruminant production in East Mamprusi District. The district was chosen because previous

interactions with farmers in that area brought out several problems experienced in their animal production activities. Furthermore, the whole district may be classified as rural, making it easier to generalize findings. (Naandam, 2001). This is the first study that presents and compares the perceptions of sheep, goat and cattle farmers on constraints to ruminant production in Ghana.

Materials and methods

A multistage sampling technique was used in choosing 516 ruminant owners from the 10 agricultural operational zones of the district. The sampling was weighted proportionally to reflect the livestock numbers in the various zones. However, a minimum sample size of 10 farmers per ruminant species per zone was chosen to facilitate statistical inference. In all, 163, 182 and 151 respondents were classified as sheep, goat and cattle farmers, respectively.

The farmers were interviewed using a questionnaire on the background of respondents, management practices, reasons for keeping livestock, reasons for choice of species to rear, and perceived constraints to and assistance for livestock production. The questionnaire used the open-ended and closed types of questions. Agricultural Extension Agents in the zone, trained before data collection, administered the questionnaire. The data were collected between February and April 2000.

Data processing involved coding of all closed questions for entry on computer using Microsoft Excel[®]. Open-ended questions that required itemization were tallied manually. Analyses involving descriptive statistics were applied using Statistix[®] software (Version 3.5, Analytical Software Inc., St. Paul, MN, USA). Tests of significance for differences in proportions or means were applied using EpiInfo[®] (Version 6.04b, Center for Diseases Control and Prevention, Atlanta, USA and World Health Organization, Geneva, Switzerland). Naandam (2001) provides details of the methods.

Results

The excellent overall response rate was 96.1 per cent (496/516). Some respondents failed to provide responses to several questions, thereby reducing response rates to specific questions, explaining why sample sizes differed. The proportions of respondents classified as sheep, goat or cattle farmers were 32.9, 36.7 and 30.4 per cent (n=496), respectively. The differences in these proportions were not significantly different. Hence, any differences seen among the three types of livestock keepers could not be due to differences in the proportions within the sample.

Background

Most respondents (78.1%, n=470) were household heads rather than household members. Male respondents were predominant, making up 91.3 per cent (n=161), 87.2 per cent (n=180) and 99.3 per cent (n=150) of sheep, goat and cattle farmers, respectively. Compared to small ruminant farmers, the proportion of males was significantly higher among the cattle farmers, buttressing the assertion that cattle-rearing is a male-dominated farming enterprise.

Overall, 83.1 per cent of the respondents did not have any formal education, 11.2 per cent had had primary education, and 3.8 per cent had had secondary or technical education, while only 1.9 per cent had had post-secondary or tertiary education. From the species kept, the proportions of illiterates were high, being 81.9 per cent (n=155), 79.2 per cent (n=178) and 89.0 per cent (n=145) of sheep, goat and cattle farmers, respectively.

Crop farming was the main occupation of the respondents, cited by 85.2 per cent (n=162), 84.0 per cent (n=181) and 95.3 per cent (n=149) of sheep, goat and cattle farmers, respectively. Significantly higher proportions of cattle owners were crop farmers, compared to those owning sheep or goats.

The proportions of respondents who owned the animals they were rearing were 94.7 per cent (n=150), 91.9 per cent (n=161) and 93.7 per cent (n=129) of sheep, goat and cattle farmers,

respectively.

The mean (\pm standard deviation) numbers of animals kept were 26 ± 18 sheep (n=163, range 4-140), 22 ± 11 goats (n=182, range 3-210), 29 ± 33 cattle (n=151, range 2-255).

The lengths of experience (mean years \pm SD) for the various categories of respondents were 13.6 years \pm 11.1 for sheep farmers (n=161), 12.6 years \pm 9.7 for goat farmers (n=179), and 22.6 years \pm 14.1 for cattle farmers (n=140). The differences in the means for years of experience were significant ($P < 0.05$). Cattle farmers had significantly longer years of experience in rearing ruminants, compared to sheep or goat farmers.

Significantly higher proportions of cattle farmers (98.0%, n=143), compared to sheep farmers (91.1%, n=158) and goat farmers (67.8%, n=183), practised the semi-intensive production system. The extensive system was more predominant among goat farmers (31.1%, n=183), compared to sheep farmers (7.0%, n=158) and cattle farmers (1.4%, n=147).

Reasons for keeping livestock

Table 1 provides various reasons given by the three types of respondents for keeping livestock. The total number of responses was more than the sample sizes, because some respondents gave more than one reason.

Reasons for choice of species to rear

Respondents were asked the basis for their choice of ruminant species to rear. Again, the responses were more than the sample sizes because some respondents gave more than one reason. Table 2 shows the proportions for the various reasons.

Knowledge of taboos against ruminant production

Respondents were asked if they were aware of any taboos against ruminant production. The proportions answering "No" were 89.7 per cent for sheep farmers (n=156), 96 per cent for goat farmers (n=175), and 91.2 per cent for cattle farmers

TABLE I

Reasons for Keeping Livestock by Type of Livestock Keeper (%)

<i>Reason</i>	<i>Sheep</i> (<i>n</i> =245)	<i>Goat</i> (<i>n</i> =250)	<i>Cattle</i> (<i>n</i> =233)	<i>P</i>
To support crop farming	26.5 ^a	17.6 ^b	33.0 ^a	0.00*
For income generation	15.1 ^b	32.0 ^a	18.0 ^b	0.00*
Provide financial security	16.7	10.8	12.9	0.15
For use in funerals	17.6	16.8	12.9	0.32
To use in marriage ceremonies	4.9	5.2	6.4	0.74
As business investment	8.2 ^a	3.2 ^b	4.3 ^{a b}	0.03*
Source of meat for family	4.9	5.6	4.3	0.80
Given as inheritance	1.6	2.0	3.4	0.39
To pay school fees	1.6	1.2	2.6	-
"I just like them"	2.0	0.4	0.0	-
It is traditional to keep them	0.0	0.4	1.3	-
Prolificacy	0.0	2.0	0.0	-
Easy to handle	0.0	1.2	0.0	-
For prestige	0.8	0.4	0.0	-
To help build a house	0.0	0.0	0.4	-
To have own property	0.0	0.4	0.0	-
Gift from friends	0.0	0.4	0.0	-
Because of high market value	0.0	0.0	0.4	-
Easy to sell	0.0	0.4	0.0	-

* = Significant at 5% significance level

Superscripts of different letters on same row are significantly different

(*n*=147). The differences in the proportions were not significant.

Some taboos identified by the few who answered 'Yes' included the following:

1. Ruminants should not be slaughtered unless it is for customary rites.
2. "Very old animals should not be kept or they may become witches and wizards."
3. Female twin kids should not be reared together.
4. Ruminants should not be sold unless there is a need.

Provision of shelter

The proportions of respondents who provided shelter for their animals were 89.5 per cent for sheep farmers (*n*=153), 88.5 per cent for goat farmers (*n*=174), and 55.2 per cent for cattle farmers

(*n*=143). Most farmers (>70%) kept their animals in pens or kraals (Table 3).

Perceived constraints

The major constraints to livestock production perceived by the livestock keepers and the proportions of respondents (*n*=1287) citing them were as follows:

1. Diseases resulting in losses or death (19.8%).
2. Housing of animals or fencing for kraals or pens or both (17.0%).
3. Feeding of animals (15.1%).
4. Lack of or high cost of veterinary drugs (14.7%).
5. Stock theft (9.9%).
6. Lack of knowledge on animal management practices (6.6%).

TABLE 2

Reasons for Choice of Species to Rear by Type of Livestock Keeper (%)

<i>Reason</i>	<i>Sheep</i> (<i>n</i> =184)	<i>Goat</i> (<i>n</i> =211)	<i>Cattle</i> (<i>n</i> =191)	<i>P</i>
Prolificacy	6.0 ^b	44.1 ^a	0.0 ^c	0.00*
Easier to handle	33.2 ^a	10.4 ^b	4.7 ^c	0.00*
Support crop farming (e.g. ploughing)	2.7 ^b	1.4 ^b	24.1 ^a	0.00*
For income generation	10.9	10.0	14.1	0.40
For funerals	13.6	9.0	7.9	0.15
To help in domestic expenses	3.8 ^b	2.4 ^b	9.4 ^a	0.00*
Higher market value	5.4 ^a	0.0 ^b	9.4 ^a	0.00*
Source of meat for family	6.0	5.2	5.8	0.94
To serve as savings	3.8	4.3	4.7	0.91
To use in marriage ceremonies	1.1	0.5	6.8	-
Less expensive to start with	3.8	3.8	0.0	-
"I like their behaviour"	2.2	2.8	2.6	-
Given as inheritance	0.5	0.5	3.7	-
Easier to market	1.6	3.3	0.0	-
For prestige	0.0	0.0	3.7	-
Good luck in rearing them	1.6	0.0	0.0	-
Multipurpose use	1.6	0.0	0.0	-
It is traditional to keep them	0.0	0.9	2.1	-
Based on father's advice	1.1	0.5	0.0	-
Gift from relatives	0.5	0.9	0.0	-
Unable to handle other species	0.5	0.0	0.5	-
For self-sufficiency	0.0	0.0	0.5	-

* = Significant at 5% significance level

Superscripts of different letters on same row are significantly different

TABLE 3

Proportions of Respondents Indicating Where Their Animals Slept in the Night (%)

<i>Sleeping place</i>	<i>Sheep</i> (<i>n</i> =162)	<i>Goat</i> (<i>n</i> =182)	<i>Cattle</i> (<i>n</i> =149)	<i>P</i>
In constructed pen or kraal	79.0	80.3	72.5	0.21
In courtyard of house	15.4 ^a	12.6 ^a	0.0 ^a	0.00*
In uncompleted room in house	3.1 ^a	4.4 ^a	0.0 ^b	0.04*
Under eaves of house	2.5	2.7	2.0	0.91
Tethered in open space, fence or under trees near house	0.0 ^b	0.0 ^b	25.5 ^a	0.00*

* = Significant at 5% significance level

Superscripts of different letters on same row are significantly different

7. Lack of water in dry season (5.3%).
8. Problems of shepherding (3.4%).
9. High mortality in young animals (2.9%).
10. Animals destroying other people's crops (2.3%).
11. Lack of capital to buy inputs (1.9%).
12. Problems of marketing (0.9%).
13. Ingestion of polythene bags by animals resulting in death (0.1%).
14. Lack of legislation on animal rearing (0.1%).

The three major constraints were diseases, housing, and feeding. Diseases and their related issues (high cost of drugs and lack of drugs, and high mortality of young ones) formed over a third (37%) of the responses. Most respondents considered diseases to be their number one problem, irrespective of the species kept, followed by housing. For small ruminant farmers, lack of knowledge on management was third; whilst for cattle owners, feeding was third (Table 4).

Perceived beneficial assistance

To meet the needs of respondents more appropriately, respondents provided what they felt would be the most beneficial assistance to improving their livestock production. Table 5 shows the proportions for the three types of livestock keepers.

Discussion

The profile of animal owners may affect how they make decisions regarding livestock production. The status, sex, level of education, main occupation, ownership, numbers of animals owned, length of experience, reasons for keeping livestock, and choice of species to rear may all contribute to the success or failure in production. Similarly, management practices such as type of production system and provision of shelter may be contributory factors.

The dominance of males and household heads in this study is important because they are the decision-makers in most homes and may, therefore, influence the adoption or rejection of whatever strategies are recommended to improve ruminant production. In some traditional societies in Ghana, although women and children own and take care of small ruminants, disposal, additions, building of shelters, and others are decided with the final approval of the household head or husband or father. The role of males and household heads in transferring and adopting technologies is, therefore, critical.

High levels of illiteracy among livestock keepers may hinder effective extension work, constraining the assimilation of new technology likely to improve ruminant production.

Most respondents indicated that their major occupation was crop farming. However, nearly all

TABLE 4

Proportions of Respondents Indicating Factor as a Number One Problem (%)

<i>Factor</i>	<i>Sheep (n=161)</i>	<i>Goat (n=118)</i>	<i>Cattle (n=144)</i>	<i>P</i>
Diseases	34.8	39.2	35.4	0.65
Housing	17.4	18.8	27.1	0.08
Lack of knowledge on management	11.2	11.0	6.3	0.25
Feeding	9.3	8.8	13.2	0.39
High mortality in young ones	9.9	5.5	3.5	0.06
Lack of drugs	7.5	9.4	9.7	0.74
Destructive nature of animals	4.3	0.6	1.4	-
Others (e.g., stealing)	5.0	5.0	3.5	0.77
No problem	0.6	1.7	0.0	-

TABLE 5

Proportions of Respondents Mentioning Factor as Most Beneficial Assistance (%)

<i>Factor</i>	<i>Sheep</i> (<i>n</i> =129)	<i>Goat</i> (<i>n</i> =115)	<i>Cattle</i> (<i>n</i> =142)	<i>P</i>
Availability of soft loans from banks or government	18.6	29.6	19.0	0.07
Provision of drugs	18.6	16.5	20.4	0.73
Provision of breeding males or improved breeds	17.1	12.2	14.8	0.56
Provision of technical advice/training	0.8 ^b	12.2 ^a	2.1 ^b	0.00*
Provision of dam/watering points	11.6	10.4	9.9	0.86
Increased number of veterinary staff or provision of a veterinary clinic	10.1	10.4	9.9	0.99
Help with treatment of diseases/vaccinations	7.8	1.8	7.7	0.07
Provision of housing or fencing	3.9	3.5	7.0	0.34
Improved feed/supplementation	3.1	2.6	4.2	-
Support against stock theft	3.1	0.9	1.4	-
Availability of grazing land	2.3	0.0	0.7	-
Bigger market/ fairer prices	1.6	0.0	1.4	-
Others	1.6	0.0	1.4	-

* = Significant at 5% significance level

Superscripts of different letters on same row are significantly different

cattle owners were also into crop farming. This may be because of the use of cattle (bullocks) for farm activities such as ploughing and hauling. Most respondents generally had crop farming as a main occupation, which emphasises that livestock production is a subsidiary enterprise. This confirms the assertion by Oyenuga (1968) that animal production is "a low labour input and a low priority adjunct to arable and cash crop farming". Ntifo-Siaw & Ghartey (1988) and Turkson (1992) have also noted that livestock production in Ghana is a secondary occupation of the rural farmer.

Ownership of an animal is important as it allows better decision-making concerning the needs of the animal. When animals in a herd are owned by various people, the herdsman or keeper has difficulty deciding on his own without first consulting the owners, thereby delaying responses. In this study, the proportions owning their animals were significantly higher.

The differences in the mean numbers of the

major species kept by the three types of livestock keepers were significant ($P < 0.05$). Compared to other studies, the average numbers of animals owned by the respondents were significantly higher. Turkson (1992) and the World Bank (1992) reported averages of nine cattle per owner and 7 to 10 sheep or goats per owner in Ghana. The higher average numbers in this study was as a result of the purposive classification into sheep, goat and cattle farmers, based on which species of ruminant the respondent kept in larger number.

There were significant differences between the three types of livestock keepers, from years of experience. Sheep and goat farmers tended to be more recent entrants to livestock production compared to cattle farmers, because traditionally animal rearing starts with a smaller animal.

Significant differences were recorded between the types of livestock keepers regarding keeping livestock to support crop farming, as a business investment, or to generate income (Table I). Significantly higher proportions of sheep and

cattle farmers kept livestock to support crop farming. The findings of this study do not support the assertion that livestock owners do not view their animals as commercial entities. The major reasons for keeping livestock may be broadly grouped into economic (to provide financial security, to support crop farming, to generate income, and as business investment) and cultural (for use in funeral and marriage ceremonies). Winrock International (1992) noted that livestock significantly improve the stability of farm enterprises by serving as living banks of capital, providing financial reserves during economic stress, and by acting as a buffer against crop failure in storing potential energy that can be eaten during food shortage. The cultural reasons involved use of livestock for social celebrations. Reijntjes *et al.* (1992) reported similar findings.

The reasons for choosing ruminant species could be broadly grouped into animal characteristics (prolificacy, docility), economic gains (supporting crop farming), or providing financial security. From Table 2, sheep were chosen for rearing more for their docility and ease of handling, while goats were chosen more for prolificacy. According to Upton (1985), goats are more prolific, but sheep are bigger, heavier and experience lower mortalities, while fetching a higher price. Cattle were chosen mainly to support crop farming.

Goat farmers significantly practised the extensive system compared to sheep and cattle farmers who used the semi-intensive system more significantly. In this study, the semi-intensive system was defined as a system in which animals were confined during part of the day and released later to be herded or to graze on their own. Few respondents kept ruminants under the intensive system in which they were confined at all times. Goats were perceived by the owners as hardier and able to fend for themselves better, making them survive well under the extensive system involving roaming about on their own always. Sheep and cattle were more likely to be in a semi-intensive system.

Sumberg & Cassaday (1985) explained that because of their propensity to wander and damage crops, sheep in South-western Nigeria were often tied or tethered during the cropping season, if they were under the extensive system. Systems for managing livestock may directly or indirectly constrain production. For instance, the morbidity rate for mange mite infestation in free-roaming goats (extensive system) in Nigeria was 23 per cent (Adeoye, 1985), compared to 5 per cent in confined goats regularly washed with acaricide in a similar environment in Nigeria (Smith *et al.*, 1988). Armbruster & Peters (1993) noted that improved management reduced early and high losses in West African dwarf goats.

Shelter is important to protect against inclement weather. Inappropriate or inadequate shelter is a recognised risk factor for respiratory diseases, especially during the rainy season. Significantly more sheep and goat farmers provided shelter for their animals, compared to cattle farmers. Because cattle are comparatively larger and, therefore, costs involved in providing shelter are prohibitive, compared to the lower costs for smaller ruminants. Also, traditionally, cattle have been kept in kraals, rather than in permanent structures with roofs. In some communities, cattle are kept and moved around in kraals on crop fields close to the homes to provide dung for fertilising the fields.

The top five perceived constraints to ruminant production were diseases, housing, dry-season feeding, lack of or high cost of inputs such as drugs, and stock theft. These were similar to the major factors mentioned by livestock keepers as their primary problem (Table 4). For cattle farmers, dry-season feeding was third after diseases and housing. Similar findings have been reported by Hanssen & Autreve (1989), Turkson (1992), Adam *et al.* (1995), and Okali (1989). These factors may directly or indirectly affect the health and well-being of the animal, and may constrain productivity and production (Winrock International, 1992).

Diseases, especially helminthiasis and ectoparasite infestation, are widespread in tropical

Africa and seriously limit the productivity of ruminants (Otchere, 1986). Gyening (1986b) noted the importance of some of these diseases as constraints to livestock production in Ghana. The need is to strengthen the delivery of veterinary services to reduce the threat of disease.

Dry-season feeding is a major problem because of the lack of fodder and forage during the long dry spell from about November to April each year, with animals losing weight and having to travel longer distances in search of food. Food quality is a major problem in the sub-humid zone of Africa where native fodders are of poor quality whilst dry-season feeds are extremely low in protein (Winrock International, 1992). A suggestion is to develop year-round feed supply based on native and improved pastures, residues and by-products of locally grown crops, cultivated legumes and forages, locally grown high-protein feeds and other feed crops adapted to an agro-ecological zone.

Stock theft may discourage livestock production. Complaints of theft similar to those the respondents mentioned have been reported elsewhere in cattle and small ruminants in the Central and Volta regions of Ghana (Amezah, Antwi & Humado, 1989; Turkson, 1992).

Mitigating programmes or packages to address some constraints identified in this study could be designed to meet the needs of the farmer. To meet these needs appropriately, the respondents suggested what they perceived as beneficial assistance. All three types of livestock keepers ranked provision of drugs, availability of loans from banks or government, and provision of breeding males or improved breeds above all other factors. These should be targeted as the basis of a package geared toward improving ruminant production in the study area.

Conclusion

The study has shown that the background and perceptions of sheep, goat and cattle farmers differed significantly in main occupation, average numbers of animals kept, years of experience,

management systems practised, and some reasons for keeping of and choice of livestock species. However, their perceptions on constraints were not significantly different. Also, most perceptions on beneficial assistance were similar. Therefore, to a large extent, a general model for improving ruminants, rather than a species-specific model, could be developed to address issues concerning constraints to ruminant production in East Mamprusi District.

REFERENCES

- Adam, I., Turkson, P. K., Apori, S. O., Agbesinyale, P., Awuma, K. S. & Micah, J. A.** (1995) *Study of traditional small ruminant production systems in 2 districts of Central Region, Ghana. Phase I. Diagnostic survey.* (Report submitted to National Agricultural Research Project, Ghana.)
- Adeoye, S. A.** (1985) Disease profiles of sheep and goats in two villages of Southwest Nigeria. In *Sheep and goats in humid West Africa. Proceedings of a Workshop on Small Ruminant Production Systems in the Humid Zone of West Africa* (ed. J. E. Sumberg and K. Cassaday), pp. 13-16. International Livestock Centre for Africa, Addis Ababa, Ethiopia.
- Akyeampong, M. K.** (1994) Keynote address. *Proceedings of the Ghana Animal Science Association Symposium 22*, 1-6.
- Amezah, A., Antwi, A. K. & Humado, C. K.** (1989) Cattle production in the Volta Region of Ghana: Practices and problems. *Proceedings of the Ghana Animal Science Association Symposium 19*, 115-121.
- Armbruster, T. & Peters, K. J.** (1993) Traditional sheep and goat production in southern Cote d'Ivoire. *Small Ruminant Research 11*, 289-304.
- Gyening, K. O.** (1986a) Livestock development in Ghana: Constraints and strategies. In *Proceedings of the 5th Conference of the Institutions of Tropical Veterinary Medicine*, pp. 103-104.
- Gyening, K. O.** (1986b) Animal health control in Ghana. In *Proceedings of the 5th Conference of the Institutions of Tropical Veterinary Medicine*, pp. 105-106.
- Hanssen, A. M. & Autreve, A. Van** (1989) Women's role in small ruminant production in the Gambia. In *Livestock production and diseases in the tropics* (ed. H. Kuil, R. W. Paling and J. E. Huhn), pp. 256-259. International Agriculture Centre, Wageningen, The Netherlands.

- Naandam, J.** (2001) *Assessment of ruminant health needs in East Mamprusi District of Ghana* (MPhil Thesis). University of Cape Coast, Ghana.
- Ntifo-Siaw, E. & Ghartey, N. K. T.** (1988) Traditional animal husbandry in farming communities: A preliminary study of three ecological zones in southern Ghana. In *Proceedings of the Ghana Animal Science Association Symposium* **18**, 58-63.
- Okali, C.** (1989) *Socio-economic information for ILCA's small ruminant programme in the Badeku and Eruwa areas, Oyo State, Nigeria*. Humid Zone Programme Working Paper No. 1, ILCA, Ibadan.
- Otchere, E. O.** (1986) Small ruminant production in tropical Africa. In *Small ruminant production in developing countries* (ed. V. M. Timon and J. P. Hanharan), pp. 203-210. FAO, Rome.
- Oyenuga, V. A.** (1968) *Agriculture in Nigeria: An introduction*. FAO, Rome.
- Reijntjes, C., Haverkort, B. & Walter-Bayer, A.** (1992) *Farming for the future: An introduction to low-external-input and sustainable agriculture*. Macmillan Press Ltd, London. pp. 92-100.
- Smith, O. B., Van Houtert, M. F. J. & Olubunmi, P.** (1988) Herd: Health problems in West African dwarf goats raised in confinement in the humid tropics. In *Goat production in humid tropics* (ed. O. B. Smith and H. G. Bossman), pp. 107-116.
- Sumberg, J. E. & Cassaday, K.** (ed) (1985) Sheep and goats in humid West Africa. In *Proceedings of the Workshop on Small Ruminant Production Systems in the Humid Zone of West Africa*, pp. 3-5. ILCA, Addis Ababa, Ethiopia.
- Turkson, P. K.** (1992) The practices and problems of rural women involved in small ruminant production. In *Proceedings of the West Africa Commonwealth Veterinary Association/Ghana Veterinary Medical Association*, pp. 20-30. Accra.
- Upton, M.** (1985) Models of improved production systems for small ruminants. In *Sheep and goats in humid West Africa. Proceedings of the Workshop on Small Ruminant Production Systems in the Humid Zone of West Africa* (ed. J. E. Sumberg and K. Cassaday), pp. 55-67. ILCA, Addis Ababa, Ethiopia.
- Winrock International** (1983) *Sheep and goats in developing countries: Their present and potential role*. A World Bank Technical Paper.
- Winrock International** (1992) *Assessment of agriculture in sub-Saharan Africa*. Winrock International Institute for Agricultural Development, Morrilton, Arkansas.
- World Bank** (1992) *Staff Appraisal Report*. Republic of Ghana. National Livestock Services Project. Report No. 11058-GH. The World Bank, Washington DC. 132 pp.