Uganda Journal of Agricultural Sciences, 2003, 8 : 169 - 174 ISSN 1026-0919
Printed in Uganda

The potential dairy farm circumstances impacting on tick and tick-borne diseases control in Mbale and sironko districts, Uganda

J.Okello-Onen[1], C. Rubaire-Akiiki[2], G. Nasinyama[2], M. Vaarst[3] and W. Mwayi[1]
[1]Livestock Health Research Institute, P.O. Box, 96, Tororo, Uganda; [2]Faculty of Veterinary Medicine, Makerere University, P.O. Box, 7062, Kampala, Uganda; [3]Danish Institute of Agricultural Sciences, Department of Animal Health and Welfare,
P.O. Box, 50, DK – 8830 Tjele.

Abstract

A cross-sectional study was conducted in smallholder dairy farms in Mbale and Sironko districts, Uganda to understand the farmer's circumstances under 4 grazing management systems and 3 agro-ecological zones (AEZs), as a basis for planning a longitudinal study. A three-stage stratified sampling methodology was performed at district, farm and animal levels. A structured and closed questionnaire was administered in a total of 102 farms that were randomly selected. The major animal health problems on the selected farms were evaluated. The study identified about 10 major farm level management practices or risk factors that could impact on tick and tick-borne diseases and their control. These are the Age; sex and breed of animals; tasks and responsibilities of household members; source of water, distance and frequency of watering; major dry season feeding strategies; access to professional service; farmers's knowledge of the problems caused by ticks and tick-borne diseases; interactions between animals; measures to control ticks and tick-borne diseases, methods and frequencies of application; categories of animals treated with acaricides; and access to professional service. The profile of these risk factors in different grazing systems and AEZs were assessed and the possible reasons for the unsustainability of tick and tick-borne disease control strategies are discussed. The impact of these risk factors on the productivity of cattle and household income will be determined during the longitudinal study. Consequently, appropriate intervention measures will be developed to alleviate these constraints.

Keywords: Ticks, tick-borne diseases, sustainable control

Introduction

The policy of Uganda government to rehabilitate and modernize the livestock industry, through increasing the supply of milk, dairy products and meat, was aimed at ensuring self-sufficiency in animal protein, enhancing household income and alleviating poverty. However, within just a decade, this policy has promoted a rapid increase in the keeping of high grade cattle in smallholder dairy farming system, most of which are located in the milkshed areas within the Lake Victoria basin (NARO, 1997). This basin is characterized by a very high human population that constantly exerts increased pressure on land. It receives over 2000mm of rainfall annually and provides an ideal condition for pasture growth and survival of the tick vectors of tick-borne diseases (Branagan, 1973). In these areas, the household families can only sustain small herds of cattle on commercial basis. However, the cattle are under constant threat of severe tick infestations and tick-borne diseases present the greatest constraint to livestock development than in any other region of the world (Perry, 1994).

Traditionally, ticks and tick-borne diseases (T&TBDs) have been controlled through heavy reliance on synthetic acaricides applied in dips or as sprays and pour-ons at frequencies of once or twice a week. However, this control practice has become unsustainable due to their escalating costs, development of acaricide

resistance in ticks, creation of endemic instability of TBDs in treated cattle population, pollution of environment and food (meat and milk) with toxic residues (Norval *et al.* 1992; Mukhebi, 1992; Mukhebi *et al.*, 1992). In addition, the control practice was generalized for all breeds of cattle, simply because the indigenous breeds of cattle were considered to be reservoirs of T&TBDs for the exotic breeds of cattle (Okello-Onen et al., 1992, 1998). The practice was not based on any sound information on tick ecology, epidemiology of TBDs and economic impacts of TBDs and their control. It was widely adopted without considering the socio-economic implications of the practice on the household income of the resource-poor farmers. More importantly, it was not targeted to the prevailing production systems and cattle population at high risk of TBDs. Currently, as a result of economic and logistical constraints, T&TBDs control practice is widely characterised by malpractice that has serious health and environmental implications (Okello-Onen et al., 1998).

The present cross-sectional study was conducted with the objective of understanding the dairy farm circumstances and risk factors that could impact on T&TBDs on smallholder dairy farms in Mbale and Sironko districts, in contrasting AEZs and grazing strata. This information will facilitate the planning of a longitudinal study that will determine the associations between the risk factors and T&TBDs and their impact on the productivity of cattle, with the ultimate aim of developing appropriate intervention measures to enhance household income as an effort to alleviate poverty.

Materials and methods

Study area

Mbale and Sironko districts, in eastern Uganda, have diverse climatic and environmental conditions due to variation in altitude and rainfall patterns. These districts are divided into five counties; Budadiri, Bubulo, Manjiya, Bungokho and Bulambuli that fall into three major AEZs; lowland, midland and upland.

Experimental design

This study incorporated a system perspective approach, on-farm research that is farmer-oriented, problem-focused and location/production system-specific. It involved implementation of a three-stage stratified sampling methodology at district, farm and animal levels. The district was stratified into three distinct agro-ecological zones; lowland, midland and upland on the basis of altitude, rainfall and agricultural activities. The sub-counties within each county were classified according to AEZs. The farms were stratified into four main grazing management systems; zero-grazing, fenced farms, tethering and free-range. The number of farms in each grazing system in a sub-county were enlisted. The estimate of the sample size of farms was based on the assumption of 50% prevalence of TBDs, at 10% allowable error (Martin et al., 1987). About 20% of farms per grazing system were randomly selected in each sub-county. The animals on the farms were stratified according to breed and age. From the selected farms, all the animals in zero and tethering grazing systems were sampled, since they were very few. However, about 50% of animals were sampled from the fenced and free range grazing systems. Overall, a total of 102 farms were visited.

Data collection

A questionnaire (structured and closed) was administered on each farm to capture information on farm characteristics, farmer's needs, problems or challenges, opportunities, coping strategies and criteria for choosing control technologies.

Data storage and analysis

Files for data were stored and managed in Microsoft Excel. The statistical analysis were performed using statistical packages in Excel and SAS (Statistical Analysis Systems).

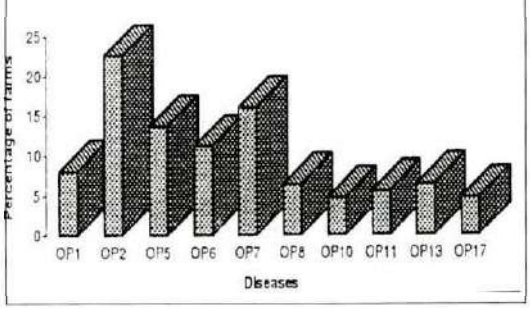
Results

Farm and animal characteristics

Farm characteristics

The cattle grazing systems were determined by land availability and AEZs. In the midland and upland AEZs, the common grazing systems were zero-grazing and tethering, while in the lowland AEZ, the popular grazing system was free range or communal grazing. In all the AEZs, fenced farms were very few.

Fig 1. Major animal health problems



Animal characteristics

Three categories of cattle were identified in all the grazing systems; exotic breeds (11.1%), cross breeds (46.4%) and local breeds (42.4%). The exotic breeds of cattle were predominant in the midland AEZ, while the cross and local breeds were predominant in the upland and lowland AEZs, respectively. The age of animals also varied in different grazing systems. Overall, 14.5%, 27.5%, 5.3% and 52.7% of animals were aged 0 – 3, 4 – 12, 13 – 24 and over 24 months, respectively.

Dairy farm circumstances

Major animal health problems on farms

The major animal health problems that confronted farmers were East Coast Fever, respiratory pneumonia, diarrhea and worm infections (Fig. 1). The magnitude of these problems varied in all the grazing systems and AEZs, but was predominant in the free range grazing systems.

General tasks and responsibilities in household

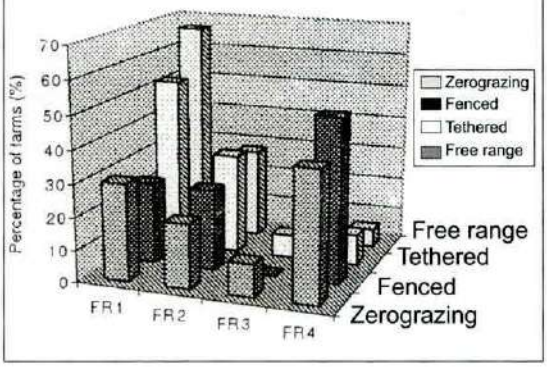
Most of the dairy farm-related activities were carried out by the household head (mostly widows), assisted by other adults in the family and hired labour. House wives were increasingly involved in these activities in areas bordering the town, while the hired labour was commonly used in rural areas.

Source of water

The major sources of water were the boreholes, protected wells and rivers or swamps. In the lowland AEZ, about 50% of farms, especially those in free range grazing systems, watered their animals directly in rivers. In the midland AEZ, about 35% and 30% of farms watered animals directly or catered water from on-farm well or boreholes, respectively. However, in the upland AEZ over 35% of farms (zero-grazing, fenced and tethering) catered water from rivers or watered animals directly in rivers (free range).

Animals under free range grazing systems walked up to 1.0 km in search for water, while those in other grazing systems moved only up to 0.3 km. In the lowland AEZ, the animals were watered only once a day, while in the midland and upland AEZs they were watered about twice a day (Fig. 2). The animals kept under zero-grazing and fenced systems were mostly watered *ad lib.*

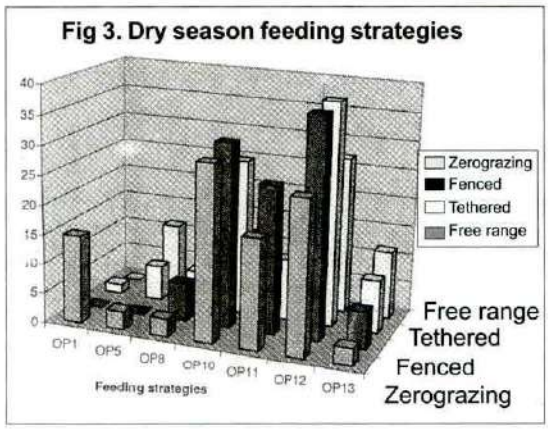
Fig 2. Frequency of watering animals



Major dry season feeding strategies

The main dry season feeding strategies were provision of fodder (from fodder banks) and tree leaves or crop peelings e.g. banana peelings (Fig. 3). Fodder was commonly given to animals under zero-grazing and fenced systems in the midland and upland AEZs. Provision of tree leaves or crop peeling (banana) was common in all grazing systems, but mainly in the midland and upland AEZs. However, in the lowland AEZ, the animals under free range grazing system were grazed along river banks or swamps during dry seasons.

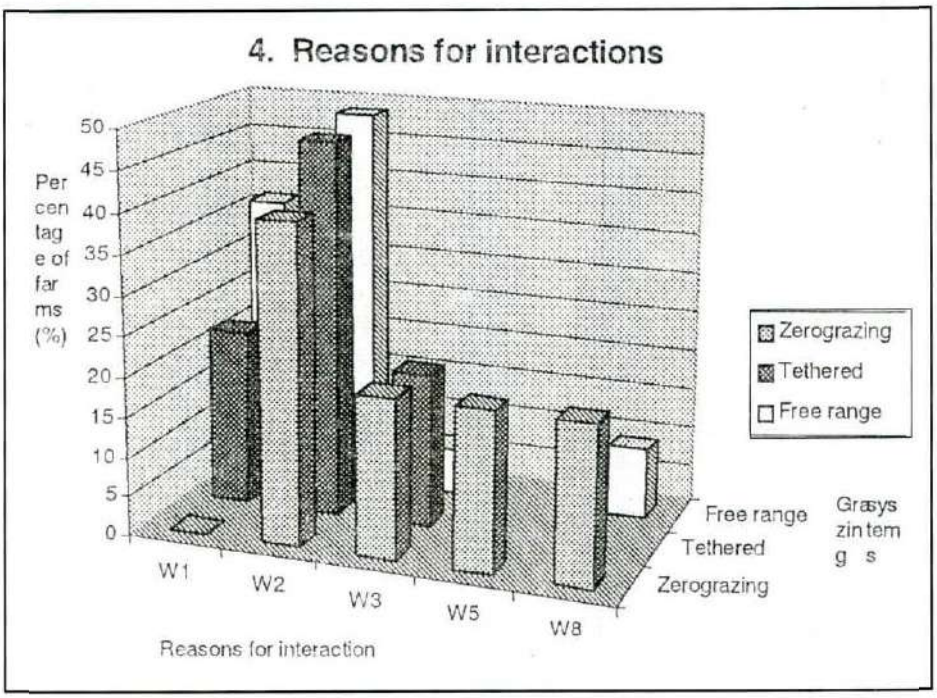
Fig 3. Dry season feeding strategies



OP1= Use stored forages; OP= send cattle on transhumance; OP8= Reduce herd size (transferred to other farms, open grazing);OP10= Purchase fodder (from fodder banks); OP11= Purchase fodder (unknown origin); OP12= Feed tree leaves/forage not normally used (e.g. banana peelings); OP13= Graze on river/road sides

Interaction between animals

Interaction between animals from different farms were experienced mainly in the tethered and free range grazing systems, in the lowland and upland AEZs. About 50%, 35% and 20% of these interactions occurred during communal grazing, watering and search for pasture in dry seasons, respectively (Fig. 4).



W1= Watering points; W2= Grazing communally; W3= Seeking a bull;
W5= Seeking a crush to restrain animals;, W8= Seeking pasture in dry seasons

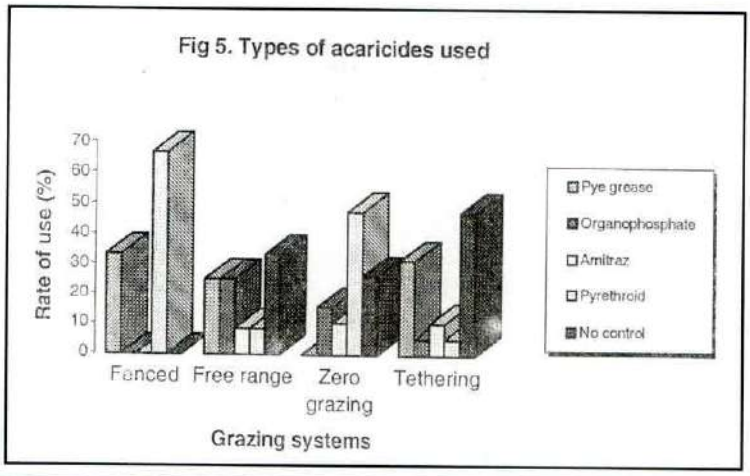
Access to professional advice

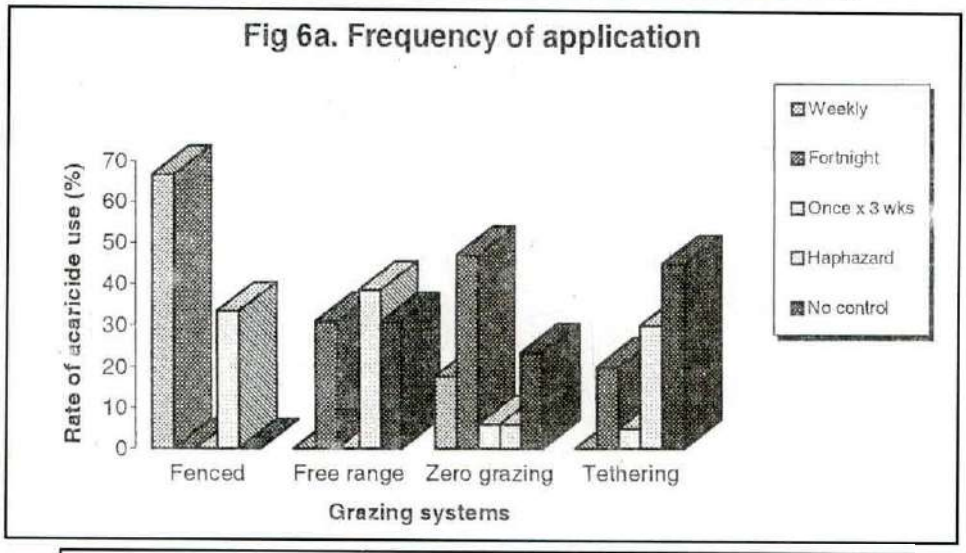
About 30% of farms in the lowland and midland AEZs had access to professional services of field veterinary staff . About 40% of these services were sought by farmers in zero-grazing and tethering systems. However, in the upland AEZ, over 60% of farmers had no access to professional advice. Most of these farmers administered the services themselves.

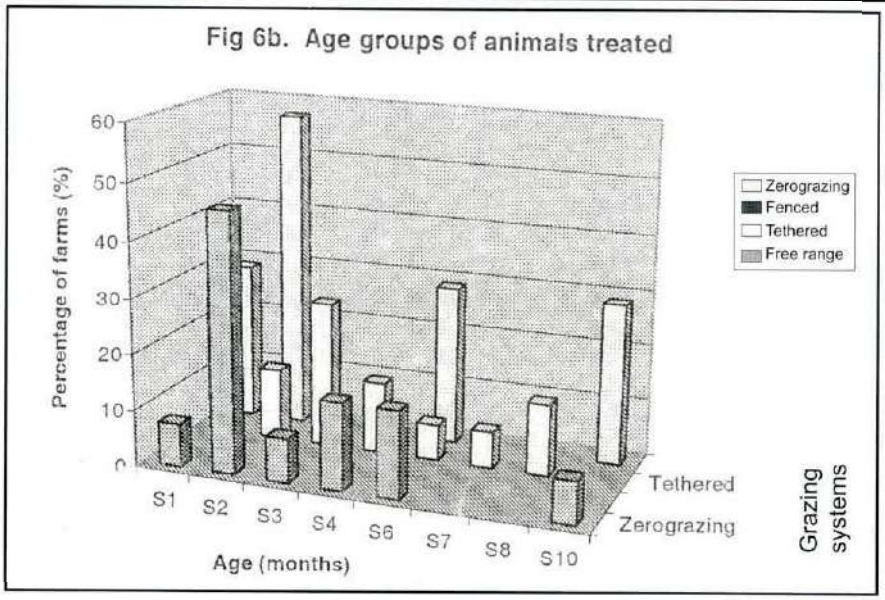
Ticks and tick-borne diseases control

The standards of T&TBDs control differed across the grazing systems and AEZs. The farmers who practiced fenced and zero-grazing systems had better knowledge of the problems caused by T&TBDs than those who practiced tethering and free range grazing systems. However, they relied mainly on ropes and physical labour to restrain their animals. About 50% and 20% of farmers in the lowland and midland and upland AEZs used acaricides to control T&TBDs, respectively. Over 70% of acaricides were used in the zero-grazing system. The acaricides used were mainly the organophosphates (OP), amitraz and synthetic pyrethroids groups (Fig. 5). Most farmers in the fenced and zero-grazing systems preferred using synthetic pyrethroids, while those in the tethering and free range grazing systems used amitraz and OP. However, most of the farmers in the upland AEZ practiced hand-picking of ticks.

The commonest methods of acaricide application were hand dressing, hand spraying and pour-on. Of these, pour-on was the most effective method of tick control. It drastically reduced tick challenge and eliminated the presence of standard ticks. Spraying and hand dressing were the most ineffective methods of tick control, and were associated with high tick challenge. The frequency of acaricide application varied with the type of acaricide and grazing system, with the commonest being weekly and fortnightly applications (Fig. 6a). However, haphazard frequencies of acaricide applications were observed in all the grazing systems, especially in the fenced, free range and tethering grazing systems. In addition, about 50% of farmers did not practice tick control, especially in the free range and tethering systems. The age of animals at which tick control started also varied across the gazing strata and AEZs, but the popular age bracket was 3 – 6 months (Fig. 6 b).







S1= < 2 months; S2= 3 months; S3= 6 months; S4= 9 months; S6= Does not know; S7= When there is a problem; S8= When ticks are visible; S10= Adults only

Discussion

The cross-sectional study provided an opportunity to understand the farm level circumstances and identify potential risk factors for T&TBDs in smallholder dairy farming system, under different grazing systems and AEZs in Mbale and Sironko districts. The objective of the study was to identify the crucial issues that need to be investigated during the longitudinal study. This logical approach was also used earlier by Gitau *et al.* (1997, 1999).

The survey showed variations in the distribution of the 4 cattle grazing systems in the 3 AEZs. The zero-grazing and tethering systems were concentrated in the midland and upland AEZs, while the free range system was predominant in the lowland AEZ. This scenario was attributed to land availability resulting from human population pressure. The roles of household members in dairy farm-related activities also differed across the grazing systems and AEZs. These roles could have a bearing on the efficiency of management of T&TBDs.

A number of risk factors for T&TBDs were identified that varied in the different grazing systems and AEZs. These include the age and breed of animals, sources of water, the distance from farms and frequency of watering animals, dry season feeding strategies, interaction between animals and their causes, knowledge of farmers on the problems caused by T&TBDs, types of acaricides used to control T&TBDs, methods of acaricide application, frequency of acaricide application and access to professional service. The association between these risk factors and T&TBDs, and their impact on cattle productivity and household income will be investigated during the longitudinal study. Ultimately, appropriate intervention measures will be developed to enhance household income as an effort to alleviate poverty. Similar studies were conducted on smallholder dairy farms in the central Kenyan highlands that identified more farm level factors or management practices (O'Calaghan, 1992).

Acknowledgments

We acknowledge the support provided by the District Veterinary Officer, Mbale and his technical staff, Drs. Wandukwa and Musunga. We thank Messrs; G. Ondyek and M. Ogik for their technical assistance. The cooperation of the smallholder farmers in responding to questionnaire interviews is highly appreciated. This study was conducted under the Livestock Systems Research Project, supported by DANIDA.

References

Branagan, D., 1973. Observations on the development and survival of the ixodid tick *Rhipicephalus appendiculatus* (Neumann, 1901) under quasi-natural conditions in Kenya. *Tropical Animal Health and Production*, 5: 153 – 165.

Gitau, G.K., Perry, B.D., Katende, J.M., McDermott, J.J., Morzaria, S.P. and Young, A.S. 1997. The prevalence of serum antibodies to tick-borne infections in cattle in smallholder dairy farms in Murang'a District, Kenya; a croo-sectional study. *Preventive Veterinary Medicine*, 30: 95 – 107.

Gitau, G.K., Perry, B.D. and McDermott, J..J., 1999. The incidence, morbidity and mortality due to *Theileria parva* infections in smallholder dairy farms in Murang'a District, Kenya. *Preventive Veterinary Medicine*, 39: 65 – 79.

Martin, S.W., Meek, A.H. and Willeberg, P., 1987. Veterinary Epidemiology. Principles and Methods. Iowa State University Press, Ames, pp. 32.

Mukhebi, A.W., 1992. Economic impact of theileriosis and its control in Africa. In: R.A.I. Norval, B.D. Perry and A.S. Young. *The Epidemiology of theileriosis in Africa*. London, Academic Press, Chapter 13, pp. 379 – 403.

Mukhebi, A.W., Perry, B.D. and Kruska, R., 1992. Estimated economics of theileriosis control in Africa. *Preventive Veterinary Medicine*, 12, 73-85.

NARO, 1997. NARO/DANIDA Livestock System Research Programme (LSRP). Proposal.

Norval, R. A. I., Perry, B. D. and Young, A. S., 1992. The Epidemiology of Theileriosis in Africa. Publishers: Academic Press Ltd. London.

O'Callaghan, J., 1992. An epidemiological study of the prevalence, risk factors and epidemiologic state of tick-borne diseases on smallholder dairy farms in Kiambu district, Kenya. M.Sc. Thesis, University of Guelph, 1992.

Okello - Onen, J., Ssekitto, C.M.B., Ssentongo, Y.K. and Kudamba, C.A.L., 1992. Tick situation and control strategies in Uganda. *Insect Science Applications*, 13 : 657-660.

Okello-Onen, J., Rutagwenda, T., Musinguzi, C., Mwayi, W. and Musisi, G. 1998. The status of ticks and tick-borne diseases under pastoral farming system in Uganda. In: Proceedings of IX International Congress of Parasitology, Makuhari Messe, Chiba, Japan, 24-28 August, 1998, pp. 537-541.

Perry, B.D. (1994). The role of epidemiology and economics in the control of tick-borne diseases of livestock in Africa. *The Kenyan Veterinarian*, 18: 7 – 10.