Demographic Parameters of N'Dama Cattle Raised under Extensive Range Management Conditions in Southern Senegal

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Key words

N'Dama cattle – Mortality – Fertility – Extensive husbandry – Senegal.

Summary

The aim of the present study was to describe demographic parameters of N'Dama cattle raised under extensive range management in Southern Senegal. The survey was conducted between 1993 and 1998. Calving, mortality, entry and exit events were individually recorded. Body condition was scored monthly for each cow over three years of age. Logistic regression models were fitted on a monthly scale to estimate the probabilities of pregnancy, mortality, and of entering and leaving the herd. The rate of pregnancy was related to the herd size, season and cow body condition. Except in the hot dry season, it was twice as high for cows scoring higher than 2.5 points for two consecutive months than for other cows. It was highest in the rainy season in large herds and in the cool dry season in smaller herds. Mortality decreased with age, with monthly adult mortality lower than 0.3%. Calf survival was related to milk availability, represented in the present study by variables concerning farmers' practices (herd size), the environment and the dam (parity, calving body condition). Between birth and three years of age, monthly mortality ranged from 0.002 to 0.06. Entry and exit rates were higher in larger herds than in smaller ones, in which the main breeding objective was the herd demographic growth. Exchanges mainly occurred during the cool dry season.

■ INTRODUCTION

Demand for animal production is increasing in subtropical regions. In Senegal, ruminants represent the main source of animal production. More than 30% of milk and dairy products are supplied locally. The agropastoral area in Southern Senegal is a major livestock production zone. In that context, the main constraints on animal production are diseases (ticks and gastrointestinal parasites) (21, 31, 41) and pastoral resource quantity and quality, especially during the late dry season when water and fodder are less readily available (34). Because of its trypanotolerance and robustness, the N'Dama breed is well adapted to the Sudanian environment (6, 22). Many authors have studied the productivity of the N'Dama reared under extensive range management in an environment similar to that in Kolda area. However, statistical analyses are not usually precisely described and results cannot be generalized. In a previous study based on the same breeding system (unpublished results), milk production and calf growth patterns were described using a body condition scoring (BCS) system. Herd productivity is furthermore related to herd growth, and thus to demographic parameters (probability of pregnancy and mortality) as well as to parameters concerning animal exchanges. In a tropical extensive range management system, cattle represent a form of savings to farmers, who sell or slaughter the animals only for cash or social events. Entries in the herd are also rare, corresponding most of the time to cattle given for a finite period by another farmer. Under such management, farmers can rear their cattle on different rangelands. Moreover, herds become large enough to be tended by a drover. Lastly, this practice increases genetic diversity within herds without buying new cows.

The aim of the present study was to set a reference for probabilities of pregnancy, mortality and management (entry and exit) of N'Dama cattle raised under a Sudanian extensive range environment (Kolda, Senegal).

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■ MATERIALS AND METHODS

Study zone and animal monitoring

This work was carried out within a field research program on extensive farming systems (14, 15, 19, 20, 36, 40). Because the aim of the program was to understand the various aspects that partake in a complex agro-ecosystem, it was focused on a single village (Sare Yero Bana) and its associated rangelands, fallow lands and cultivated fields (20, 37). This site was selected as agro-ecologically representative of the smallholders' Sudanian area. Its activities and organization were typical of Kolda region, which is relatively homogeneous in terms of relief, climate, cropping and animal management. This village was located 15 km from Kolda (latitude 12.88°N, longitude 14.94°W) in Upper Casamance (Senegal).

Kolda's climate is Sudano-Guinean with a geoclimatic pattern and average annual rainfall of 1110 mm. For the purpose of the study, the year was divided into three seasons of four months. The rainy season (RS), between July and October, was followed by the cool dry season (CDS) from November to February and then by the hot dry season (HDS) from March to June. As supplementary feeding was not a common practice in the studied village, the seasonal effect was mainly due to variations in pasture feed availability and quality.

The village land consisted of 110 ha planted with maize, millet, groundnut, sorghum and rice and 4500 ha of natural rangelands and fallow lands. In the studied village, cattle were bred in 10 herds of varying sizes (20 to 210 animals in an average year). They were mainly N'Dama, a trypanotolerant taurine breed well adapted to the Sudanian environment (25). Herd management has already been described (8, 18). Herds grazed on fallow lands and woody savannah from ploughing to harvest time. After harvesting, animals were fed on crop residues. During HDS, when fodder availability decreased, they were left to roam around the village. Reproduction was uncontrolled. Field observations showed that 54% of calvings occurred between July and October, with an average age at first calving of five years (4-9 range) and an average calving interval of 27 months (11-47 range).

A longitudinal study was conducted from 1993 to 1998. The individual follow-up method was designed by Faugère (11). Cattle were identified by a plastic ear tag. Two professional enumerators, supervised by the second author of this paper, visited the herds twice a month. The total number of cattle monitored was 1286 (744 females and 542 males), 712 (470 females and 242 males) of which reached at least three years of age during the survey. The records included demographic events (births, deaths, entries and exits) and a body condition score (BCS) of the cows. BCS ranged between 0 and 5 points (8, 29) and was given by one technician, the same one for all the cows throughout the survey. Data were stored in a relational database (23) and validated before analysis.

Data analysis

The probability of pregnancy was the probability in any month *t* of an open cow becoming pregnant. As abortions were not recorded during monitoring, the probability of pregnancy was here equivalent to a probability of calving. The probability of entrance in the herd corresponded to the probability of purchase and donation. The probability of exit corresponded to the probability of voluntary and involuntary culling and donation. Pregnancy, mortality, entry and exit probabilities were estimated with survival models for grouped data (logistic regressions with a log-it link; 7). The observed data was compiled by monthly periods and monthly age stages. A monthly scale was retained to compete the risks of failure (26). The data was finally aggregated by season (RS, CDS and HDS) and age class (0-3, 4-6, 7-12 and 13-36 months for juveniles; over three years of age for adults). Each response was established as the proportion $y_i = r_i / m_i$, where r_i was the number of observed cases and m_i the number of individuals at risk for covariable pattern *i*. The model was as follows:

$$\log\{\mu_i / (1 - \mu_i)\} = x_i\beta$$

$$E(Y_i) = \mu_i$$

$$Var(Y_i) = \frac{\mu_i (1 - \mu_i)}{m_i}$$

where β was the vector of the linear predictors, x_i the vector of the explanatory variables and μ_i the expected values for covariate pattern *i*. A three-step procedure was used to select the best model for each type of response (pregnancy, mortality, entry and exit).

Step one

A full model was constructed with all the explanatory variables of interest (Table I). Because the explanatory variables were not identical for both sexes and all age classes, separated models were adjusted for juveniles (n = 517), adult females (n = 368) and adult males (n = 242), except for adult mortality for which occurrence was low and males and females were analyzed simultaneously. On one hand, the studied responses were related to the characteristics of the animals (35) or of the dams (27), such as the reproduction stage, age or body condition. On the other hand, they were related to the farmers' objectives and financial means, which were represented by the herd size (large herds: more than 100 animals every year; small herds: less than 100 animals at least for one year), with the small herds being more sensitive to seasonal or accidental variations in health status, forage availability or prices than the large herds. Among the observed data, yearly variations only occurred in adult mortality. Hence, the year factor was only included in the model estimating the probability of adult mortality. The threshold of 2.5 points was pertinent to classify cows according to their monthly body condition (8). The sign of BCS change was also tested but was not reliably related to productive performance (not discussed here; 8).

Step two

The explanatory variables were stepwise selected with a backward procedure based on Akaike's information criterion (AIC), where AIC = -2*log-likelihood+2*k, k being the number of parameters in the model. AIC is a trade-off between bias and variance, or between underfitting and overfitting (1). The model with the smallest AIC is retained.

Step three

The significance of the explanatory variables included in the selected model was checked with tests of difference of deviances. Tests of lack of fit of the model were checked with the Hosmer and Lemeshow test (17), and the Osius and Rojek test (33).

The predicted monthly probabilities were then used to calculate the annual probabilities of mortality, pregnancy, entry and exit with the following equation:

$$P_{year} = (1 - (1 - P_{month})^{12})$$

■ RESULTS

Probability of pregnancy

The model estimating the probability of pregnancy and minimizing AIC included season, parity, BCS for two consecutive months and

Table I

Description of the explanatory variables included in the most complete model for each response

Pregnancy		Mortality		Entry			Exit		
		Juvenile	**Adult**	**Juvenile**	**Female**	**Male**	**Juvenile**	**Female**	**Male**
Season	RS CDS HDS	RS CDS HDS	RS CDS HDS	RS CDS HDS	RS CDS HDS	RS CDS HDS	RS CDS HDS	RS CDS HDS	RS CDS HDS
Age		[0; 6]]6; 12]]12; 36 months]	[3; 4] ≥ 5 years	[0; 6]]6; 12]]12; 36 months]		[3; 4[[4; 5[≥ 5 years	[0; 6]]6; 12]]12; 36 months]		[3; 4[[4; 5[≥ 5 years
Herd size	Small[1] Large[2]	Small Large	Small Large	Small Large	Small Large	Small Large	Large	Small Large	Small Large
Year			1993-1997						
Parity	N[3] P[4] M[5]	P M			N P M		P M	N P M	
Sex				Male Female			Male Female		
BCS_c[6]		U; A					U; A		
BCS_t	U; A				U; A			U; A	
BCS_{2m}	UU; AU; UA; AA								
PS[7]	RSt				LG-EL EG-RSt			EG-RSt	

RS = rainy season; CDS = cool dry season; HDS = hot dry season

[1] Less than 100 head over at least one year; [2] More than 100 head every year

[3] Nulliparous cows; [4] Primiparous cows; [5] Multiparous cows

[6] Body condition score at calving (BCS_C), during month *t* (BCS_t) and during the two previous months (BCS_{2m}): U = under 2.5 points; A = equal or above 2.5 points on a five-point scale

[7] Physiological status: LG-EL = late gestation and early lactation; EG-RSt = early gestation and remaining states; RSt = remaining states

the interactions between season and parity and between season and BCS (Table II). The probability of pregnancy was highest for cows scoring greater than 2.5 points for two consecutive months. Regardless of the parity, the probability of pregnancy was higher during CDS. For nulliparous and primiparous cows, it was higher during RS than during HDS, whereas for multiparous cows it was higher during HDS. Except during RS, multiparous cows had a higher probability of pregnancy than nulliparous and primiparous cows (Figure 1; Table III). On average, the annual probability of pregnancy was 0.317 (S.E. = 0.035).

Probability of mortality

For the juveniles, the AIC selected model included the herd size, season of birth, age of the calf, parity, BCS at calving (BCS_C) of the dam and interactions between season and BCS_C and between age and parity (Table II). The probability of mortality was lower in large herds than in small ones. BCS_C of the dam especially influenced the mortality of calves born in HDS and in RS in small herds. Whatever the herd size, the mortality probability was lower during CDS than during HDS and RS. Moreover, it was higher between birth and 6 months of age for calves born to primiparous cows, whereas it was higher between 7 and 12 months of age for calves born to multiparous cows (Figure 2). The annual probabilities of mortality by age groups are reported in Table III.

For the adults, the AIC selected model included the season and the year (Table II). The monthly probability was higher in HDS and then in RS than in CDS. It was much lower in 1996 than in the other years (0.0004 in HDS in 1996 vs from 0.002 to 0.003 in HDS in the other years). Overall, the annual adult mortality was low (0.018; S.E. = 0.001). One noticeable feature was that, among

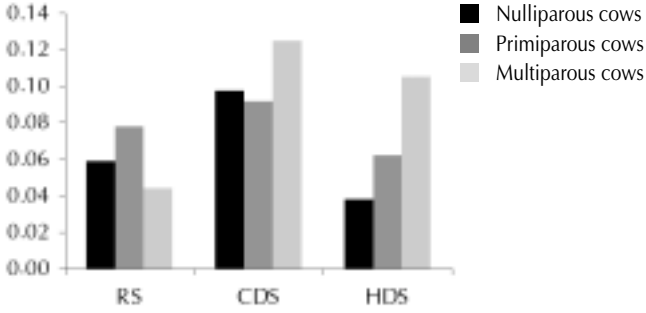

Figure 1: *Monthly probability of pregnancy of cows scoring greater than 2.5 points in the two previous months for body condition, estimated by logistic regression by parity and season (RS = rainy season; CDS = cool dry season; HDS = hot dry season).*

females, only those who were neither in late pregnancy nor in early lactation and scoring less than 2.5 points for the two previous months presented mortality.

Probability of entrance

For the juveniles, the AIC selected model included the herd size, season and age (Table II). The probability of entrance was low. The annual probabilities by age groups and herd size were 0.009 (S.E. = 0.001) vs 0.088 (S.E. = 0.009) for 0-1 year of age and 0.002 (S.E. < 0.001) vs 0.017 (S.E. = 0.002) for 1-2 years of age, in small herds compared to large herds. The monthly probability of entrance was higher during CDS: from 0.004 to 0.022 in CDS and less than 0.005 in RS and HDS.

For the adult males, the AIC selected model included the season, herd size and age (Table II). The annual probability was almost twice as high in large herds than in small ones: on average 0.113

Table II

Logistic regression models selected by AIC[1] for probabilities of conception, mortality, entry and exit of N'Dama cows in Kolda (Senegal) between 1993 and 1998

Models	Deviance	HL test[2]	OR test[2]
Pregnancy season + parity + BCS_{2m} + (season * parity) + (season * BCS_{2m})	11.17	0.99	0.64
Juvenile mortality herd size + season + age + parity + BCS_C + (season * BCS_C) + (age * parity)	64.34	0.90	0.57
Adult mortality season + year	53.19	0.19	0.82
Juvenile entrance herd size + season + age	18.22	0.13	0.61
Adult male entrance herd size + season + age	10.69	0.94	0.61
Cow entrance herd size + season	34.04	0.93	0.86
Juvenile exit sex + season + BCS_C + age + (sex * age)	53.67	0.55	0.74
Adult male exit herd size + season + age + (herd size * season) + (season * age)	13.90	0.92	0.22
Cow exit herd size + season + BCS_t + (herd size * BCS_t) + (herd size * season)	30.03	0.64	0.28

[1] Akaike information criteria

[2] P-value for the global Hosmer and Lemeshow test (HL test) and the Osius and Rojek test (OR test)

BCS_{2m} = body condition score during the two previous months

BCS_C = body condition score at calving

BCS_t = body condition score during month *t*

Table III

Annual probabilities per state of parity for pregnancy and per age class for mortality, entry and exit of N'Dama cows

	Juveniles[1]			Adult cows[2]			Adult males[3]		
	[0-6]	]6-12]	]12-36]	N	P	M	[3-4[	[4-5[	≥ 5
Pregnancy[4]				0.26 (0.03)	0.32 (0.03)	0.37 (0.04)			
Mortality[4]	0.17 (0.01)	0.14 (0.02)	0.10 (0.01)			0.02 (0.001)			
Entry[4]	0.06 (0.01)	0.04 (0.01)	0.01 (0.001)		0.19 (0.02)[5]		0.12 (0.01)	0.27 (0.02)	0.15 (0.01)
Exit[4]	0.25 (0.02)	0.18 (0.02)	0.06 (0.01)				0.37 (0.02)	0.40 (0.02)	0.47 (0.02)

[1] Age classes for juveniles are expressed in months

[2] Parity states for adult cows are nulliparous (N), primiparous (P) and multiparous (M)

[3] Age classes for adult males are expressed in years

[4] Standard errors are expressed in parentheses

[5] Concerns only cows that were neither pregnant nor in early lactation

(S.E. = 0.008) vs 0.245 (S.E. = 0.018) in small and in large herds, respectively, and twice as high for four-year-old males than for younger and older ones (Table III). The annual probabilities by age groups were 0.120 (S.E. = 0.008), 0.270 (S.E. = 0.020) and 0.147 (S.E. = 0.011) for males aged 3, 4 and 5 years or more. The probability of entrance was higher in RS, and then in CDS (Figure 3).

For the adult females, the AIC selected model included the herd size and season (Table II). In small herds, the annual probability of entrance was almost zero (< 0.004). In large herds, entrance essentially occurred during the dry season: monthly probabilities were below 0.001 in RS vs 0.02 and 0.008 in CDS and HDS, respectively.

Probability of exit

For the juveniles in large herds, the AIC selected model included sex, season, BCS_C of the dam, age and the interaction between sex and age (Table II). Very few calves left during RS (< 0.002). The probabilities of exit were similar in CDS and HDS. Calves born to cows scoring less than 2.5 points at calving left twice as often as calves born to cows scoring greater than 2.5 points at calving, with annual probabilities of 0.106 (S.E. = 0.009) and 0.224 (S.E. = 0.020), respectively. The probability of exit decreased with age (Table III). Sex did not affect calf exit between birth and six months of age. Between seven and twelve months of age, females left more often than males. After one year of age, females hardly left the herd, whereas males left it as much as between seven and twelve months of age (Figure 4).

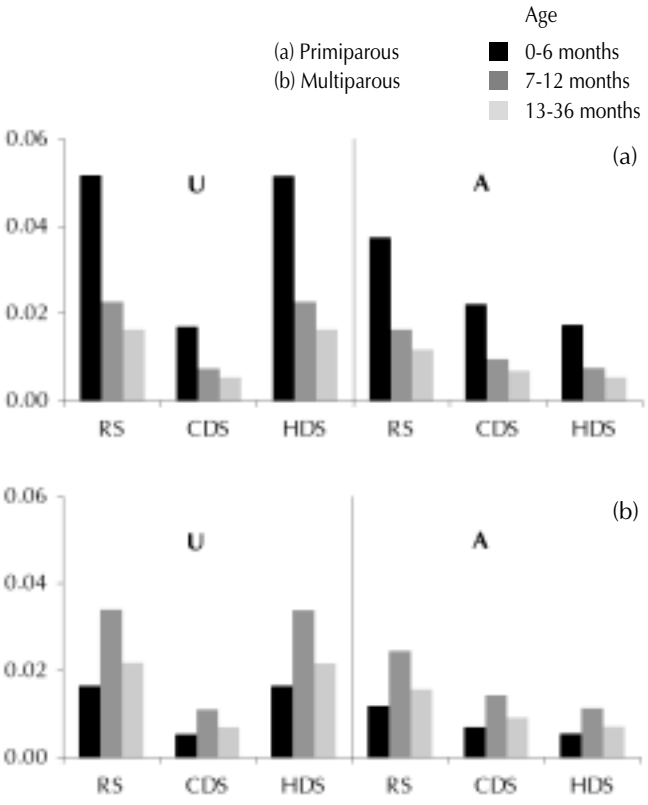

Figure 2: *Monthly probability of juvenile mortality (between birth and 36 months of age), estimated by logistic regression by season of birth (RS = rainy season; CDS = cool dry season; HDS = hot dry season), age, herd size (only small herds are shown here; the pattern for large herds was identical but probabilities were lower), parity and calving body condition score of the dam (U < 2.5 points; A > 2.5 points on a five-point scale).*

For the adult males, the AIC selected model included the season, herd size, age and the interactions between season and herd size and between season and age (Table II). Overall, the probability of exit increased with age (Table III). The patterns were different between large and small herds (Figure 5). The probability was lower in small than in large herds, with annual probabilities of 0.330 (S.E. = 0.017) and 0.493 (S.E. = 0.018), respectively.

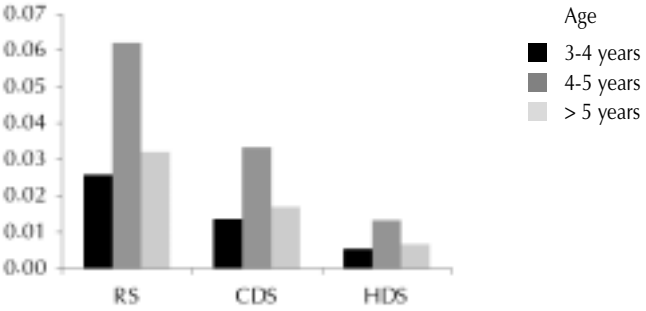

Figure 3: *Monthly probability of entering the herd for adult males, estimated by logistic regression for large herds by age and season (RS = rainy season; CDS = cool dry season; HDS = hot dry season).*

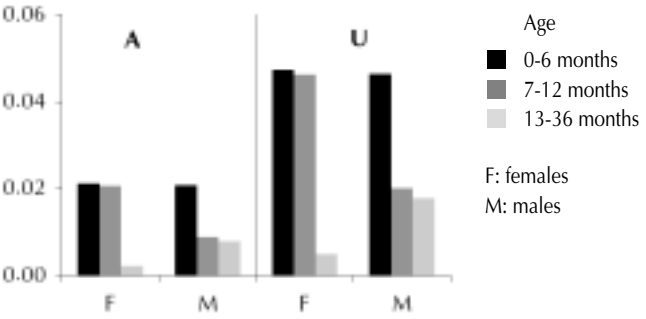

Figure 4: *Monthly probability of leaving the herd for juveniles (from birth to three years of age) in large herds, estimated by logistic regression by age, sex, calving body condition score of the dam (U < 2.5 points; A > 2.5 points on a five-point scale) and season; exit rates in the rainy season were low (< 0.002) and are not represented here; exit rates in the cool and hot dry seasons were identical.*

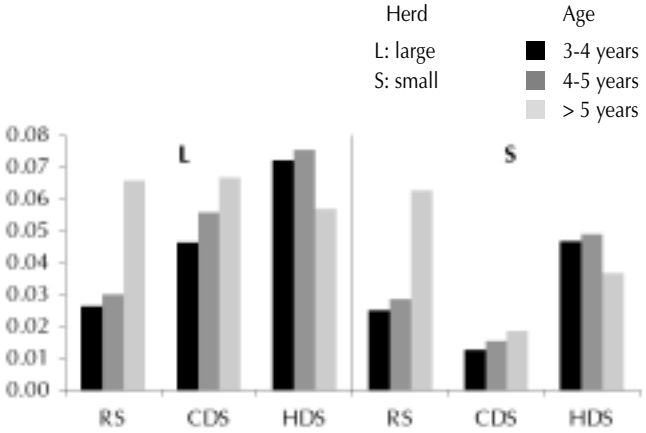

Figure 5: *Monthly probability of leaving the herd for adult males, estimated by logistic regression by herd size, season (RS = rainy season; CDS = cool dry season; HDS = hot dry season) and age.*

In large herds, exit preferentially occurred in the dry season, especially in HDS, except for males over five years of age, which left all year round. In small herds, exit occurred in both HDS and RS, but almost never in CDS.

Females in late pregnancy or in early lactation never left the herd. The analysis for adult females was therefore only based on females in other physiological states. The AIC selected model included herd size, season, BCS for the month considered and the interactions between herd size and BCS, and between herd size and season (Table II). Cows left more often the herd during the dry season than during the rainy season. In small herds, only thin cows (BCS < 2.5 points) left, whereas in large herds the probability of exit was higher for cows scoring greater than 2.5 points (Figure 6). On average, the annual probabilities were 0.293 (S.E. = 0.016) vs 0.078 (S.E. = 0.010) in large and small herds, respectively.

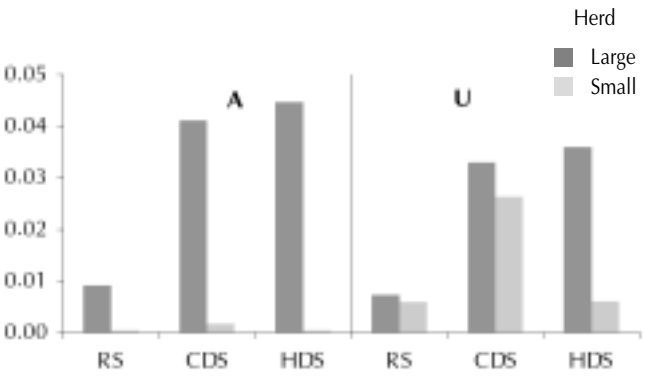

Figure 6: *Monthly probability of leaving the herd for cows in neither late pregnancy (last three months) nor early lactation (first three months), estimated by logistic regression by herd size, season (RS = rainy season; CDS = cool dry season; HDS = hot dry season) and body condition score (U < 2.5 points; A > 2.5 points on a five-point scale).*

■ DISCUSSION

Improvement of the probability of pregnancy and juvenile survival

The average annual probabilities of pregnancy and of juvenile mortality estimated in the present study tally with other estimations on N'Dama cattle under a traditional range management system (Tables IV and V). In the tropics, the probabilities of pregnancy and of juvenile mortality are essentially influenced by forage availability (5) and characteristics of herd and cows (health status, body condition, etc.) (4, 41). Cows in moderate to good body condition have a higher probability of conceiving than other cows; there is a reduced ovarian activity for cows scoring less than 2.5 points on a five-point scale (28). In the present study, most of the pregnancies began during the period of good forage availability and quality (crop residues or rainy season). The season also affected the calf mortality, especially when the dam was thin. Cows in good body condition can mobilize their body reserves to produce enough milk in early lactation to cover their calf's needs, even when calving occurs in the dry season. The mortality was lower in CDS, then in RS. Both seasons are characterized by generally good forage availability for cows and for calves around six months old at the beginning of weaning.

Results obtained in station (2, 10, 32, 39) or after strategic health treatment (41) show that the annual probability of juvenile mortality could decrease to below 10% and that the annual probability of calving could exceed 70%. The present results indicated that control of N'Dama cattle feeding in an extensive management system might notably increase the number of calvings or enable control of the calving season. By increasing the number of conceptions in HDS, i.e. the number of calvings occurring in CDS, juvenile mortality would probably drop and milk production would increase in a season when milk is rare (9).

Mortality

The mortality was higher during the first six months of life for calves born to primiparous cows, whereas it was higher between seven and twelve months of age for calves born to multiparous cows. This difference might be related to the higher milk production potential of multiparous cows. After the first months of life, calves lose the immunity provided by the consumption of colostrum and are dependent on their mother's milk. The mortality could also be related to the health status of the herd, which depends on its size and on the occurring season. Firstly, farmers owning a small herd have generally more limited financial means. They therefore cannot afford repeated veterinary operations. Secondly, disease occurrence is higher during RS (intestinal parasites, ticks, diarrhea) and HDS (dehydration) than during CDS (30).

Adult mortality was low. No mortality was observed among pregnant and lactating cows. In fact, females with health problems do not generally reproduce. Cows in late pregnancy or in early

Table IV

Comparison of annual probabilities of pregnancy and calving in N'Dama cows observed in different studies

Reference	Country	Environment	Probability	Value
The present study	Senegal	Village	Pregnancy[1]	0.32
Coulomb J., 1976, *Revue Elev. Méd. vét. Pays trop.*	Côte d'Ivoire	Station	Fertility[1]	0.88
Godet G. *et al.*, 1981, *Revue Elev. Méd. vét. Pays trop.*	Côte d'Ivoire	Village	Fertility	0.38 to 0.44
Tuah A.K. and Danso Y.N., 1985, *Trop. Anim. Health Prod.*	Ghana	Station	Fertility	0.72
Dejode A. *et al.*, 1992, *Trop. Anim. Health Prod.*	Nigeria	Village	Pregnancy	0.02–0.14 month^{-1}
Zinsstag J. *et al.*, 1997, *Vet. Parasitol.*	The Gambia	Village	Fertility	0.44

[1] The probability of pregnancy is here the number of cows that became pregnant relatively to the number of open cows present in the herd during the year, whereas the fertility is the number of calvings that occurred in the year relatively to the number of adult cows present in the herd

Table V

Comparison of annual probabilities of mortality in N'Dama cattle observed in different studies

Reference	Country	Environment	0-1 yr	1-2 yrs	Adult
The present study	Senegal	Village	0.16	0.10	0.02
SATEC, 1973	Senegal	Village	0.30	0.15	0.05
Fall A. *et al.*, 1982, ILCA	Senegal	Station	0.10		
Tuah A.K. and Danso Y.N., 1985, *Trop. Anim. Health Prod.*	Ghana	Station	0.10		
Njie M. and Agyemang K., 1991, *Trop. Anim. Health Prod.*	The Gambia	Station	0.06		
Dejode A. *et al.*, 1992, *Trop. Anim. Health Prod.*	Nigeria	Village	0.24		
Mourad M. and Magassouba B., 1996, *Revue Elev. Méd. vét. Pays trop.*	Guinea	Private breeding	0.14	0.17	
Itty P. *et al.*, 1997, *Prev. vet. Med.*	The Gambia	Village	0.21	0.01	0.04
Zinsstag J. *et al.*, 1997, *Vet. Parasitol.*	The Gambia	Village	0.07	0.01	0.05

lactation should be in better health than open cows. Adult mortality was lower in 1996 than in the other years: 1995 and 1996 were the two driest years (less than 960 mm of rain), which could have influenced adult mortality.

Cattle management

As far as the authors know, there is no literature available on cattle management in a traditional tropical environment. In temperate climates, the renewal is related to the cow BCS and health status (12). Moreover, for dairy cows it is generally based on milk production during early lactation (16). The renewal pattern under an extensive tropical management system may be very different as there are substantial feeding constraints. The environment is highly influential and over-conditioning is rarely a problem. In such a context, a cow, which presents a poor production at one time, cannot be considered as unproductive. The animal flow should then be based on biological factors influencing subsequent performance, such as milk potential, reproductive status, cow health or body condition (24).

On the other hand, as the main breeding aim under traditional management systems is livestock capitalization, cattle exchanges depend on variations in the herd size and on breeders' financial means. The smaller the herd, the more sensitive it is to its environment. In small observed herds, the ratio between males and females varied with time and sometimes equaled one to one. Conversely, the structure of large herds was generally stable from year to year, the number of males representing about half the number of females. Moreover, in Sare Yero Bana, there were no breeders involved in the commodity of beef cattle production, nor in bull fattening for either fieldwork or reproduction. Hence, animals were only sold when cash was needed, which generally occurred between the late rainy season and harvest time (CDS). Prices in CDS were generally not attractive, supply being greater than demand. However, irrespective of the herd size, breeders did not sell pregnant or lactating cows but bulls and thin cows or cows that had not calved for some time, such as old nulliparous and primiparous cows.

■ CONCLUSION

The present study gives a description of the demographic parameters of N'Dama cattle reared under extensive management systems in Southern Senegal. The probability of pregnancy was highest in the rainy season in large herds and in the cool dry season in smaller herds. Calf survival was related to farmers' practices, the environment and the dam. Both rates were lower than those reported in a more controlled environment, suggesting that herd productivity may increase with the feeding level. In small herds, the main breeding objective was herd growth, which resulted in low exit rates. Animal flows mainly occurred during the early dry season.

Acknowledgments

This study was conducted under the joint "Alimentation du bétail tropical" program, run by ISRA-LNERV and CIRAD-EMVT. We would like to thank the Livestock Directorate and farmers of Sare Yero Bana village for their friendly collaboration.

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Reçu le 06.11.2002, accepté le 25.08.2003

Résumé

Ezanno P., Ickowicz A., Faye B. Paramètres démographiques des bovins N'Dama en milieu pastoral extensif dans le sud du Sénégal

L'objectif de cette étude a été de décrire les paramètres démographiques des bovins N'Dama en élevage extensif dans le sud du Sénégal. Le suivi zootechnique a eu lieu de 1993 à 1998. Les mises bas, les cas de mortalité, les entrées et les sorties du troupeau ont été relevés individuellement. L'état corporel a été noté mensuellement pour chaque vache de plus de trois ans. Des régressions logistiques ont été ajustées sur un pas de temps mensuel pour estimer les probabilités de gravidité, de mortalité, et d'entrée et de sortie du troupeau. Le taux de gravidité dépendait de la taille du troupeau, de la saison et de l'état corporel des vaches. Excepté en saison sèche chaude, il a été deux fois plus élevé chez les vaches ayant eu une note supérieure à 2,5 points pendant deux mois consécutifs que chez les autres vaches. Il a été plus élevé en saison des pluies dans les grands troupeaux et en saison sèche fraîche dans les petits troupeaux. La mortalité a diminué avec l'âge, avec une mortalité mensuelle adulte inférieure à 0,3 p. 100. La survie des veaux dépendait du lait disponible, représenté ici par des variables reliées aux pratiques des éleveurs (taille du troupeau), à l'environnement et à la mère (parité, état corporel à la mise bas). Entre la naissance et trois ans, la mortalité mensuelle a varié de 0,002 à 0,06. Les taux d'entrée et de sortie des grands troupeaux ont été supérieurs à ceux des petits troupeaux, dans lesquels l'objectif principal a été la croissance démographique du troupeau. Les flux d'animaux ont eu lieu principalement pendant la saison sèche fraîche.

Mots-clés : Bovin N'Dama – Mortalité – Fertilité – Elevage extensif – Sénégal.

Resumen

Ezanno P., Ickowicz A., Faye B. Parámetros demográficos del ganado N'Dama criado bajo condiciones de manejo extensivas en el sur de Senegal

El objetivo del presente estudio es el de describir los parámetros demográficos del ganado N'Dama criado bajo condiciones de manejo extensivas en el sur de Senegal. El estudio se llevó a cabo entre 1993 y 1998. Se registraron individualmente los eventos de entradas y salidas, de número de parto y de la mortalidad. La condición corporal se anotó mensualmente para cada vaca mayor de tres años de edad. Se realizaron modelos de regresión logística a escala mensual, con el fin de estimar las probabilidades de preñez, mortalidad y de entrar y salir del hato. La tasa de preñez estuvo relacionada con el tamaño del hato, estación y condición corporal de la vaca. A excepción de la estación seca y caliente, esta tasa fue dos veces más elevada en las vacas que registraron más de 2,5 puntos durante dos meses consecutivos que las otras vacas. Fue más elevada durante la estación lluviosa en los hatos grandes y en la estación seca y fría en los hatos menores. La mortalidad disminuyó con la edad, con una mortalidad adulta mensual menor de 0,3%. La supervivencia del ternero estuvo relacionada con la oferta de leche, representada en este estudio por variables concernientes a las prácticas de los finqueros (tamaño del hato), el medio ambiente y la hembra (número de parto y condición corporal al parto). Entre el nacimiento y los tres años de edad, la mortalidad varió entre 0,002 y 0,06. Las tasas de entrada y salida del hato fueron superiores en los hatos grandes que en los pequeños, en los cuales el principal objetivo de la cría fue el crecimiento demográfico del hato. Los intercambios se dieron principalmente durante la estación seca y fría.

Palabras clave: Ganado bovino N'Dama – Mortalidad – Fertilidad – Ganadería extensiva – Senegal.