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Original Research Article

Characterization of Cattle Farming in Savanna and Forest Areas in Cote D'ivoire

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Abstract: The aim of this study was to characterize cattle (*Bos Taurus)* breading system in savannah and forest areas in Côte d'Ivoire. To achieve this objective, a formal survey was carried out among 490 breeders. It was carried out by surveys and interviews to characterize the farms. The rearing system, the different breeds bred, the size of the herd, the mode of reproduction and the other associated animal species with cattle breading were observed. The observations were compared by department and agro-ecological zone. The results showed two farming systems. These are the transhumant system and sedentary system. The sedentary system is more used ($P<0.05$), i.e. 79% of breeders. However, the transhumant system is still common in savannah areas. The livestock was composed mainly of zebu 28%, mestizos 33% and mixed (Zebu, mestizos, Méré, N'dama and Baoulé breeds). The local breeds Méré, Ndama and Baoulé represented less than 2% of the livestock. The size of the herd was less than 100 head in majority ($P<0.05$). Cattle farming was often associated with traditional poultry farming. This activity is secondary for 70.6% of breeders. The reproductive system was carried out in an uncontrolled manner. The breeding males were in the herd all the time.

Keywords: Breeding system, reproduction, herd size, cattle, Côte d'Ivoire.

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INTRODUCTION

Livestock farming is still a secondary economic activity in Côte d'Ivoire. It contributes only 4.5% to agricultural GDP and 2% to total GDP (Sokouri *et al*., 2009). National production covers less than 51% of national consumption of meat and 17% of dairy products. However, in the early 1990s, Côte d'Ivoire initiated a policy to reduce this deficit. It has thus developed breeding around the main cities (Arbetot *et al*., 1997). This policy made it possible to meet egg needs, the coverage rate of which reached 100% (Koffi *et al*., 2001). This policy made it possible to meet egg requirements. This policy has made it possible to cover egg consumption. The coverage rate is therefore 100% (Koffi *et al*., 2001). However, much work still needs to be done to fully meet demand for animal products, especially in cattle breeding. Cattle breeding is present in all regions of Côte d'Ivoire. The practices and behaviors of the animals observed are diverse. Thus, some breeders have introduced improved breeds to increase productivity. Others are increasingly using growth promoters in feed and synthetic veterinary products to improve farm performance. There is very little reliable data available on the interactions between these different practices and their consequences on cattle farms. There are only a few recent studies that present the typology of cattle farmers. These studies have focused on social, structural and husbandry characteristics (Sokoury *et al*., 2009; Soro *et al*., 2015; Yéo *et al*., 2017). They were mainly carried out in the savannah areas of central and northern Côte d'Ivoire. The forest area that represents a different agroecological zone has not been studied. However, this area contains many cattle farms often associated with perennial crops.

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This study aims to characterize the cattle farming systems encountered in Côte d'Ivoire. It will help improve the performance and profitability of farms while reducing the impact on the environment.

MATERIAL AND METHODS

The study was carried out through a survey of 490 cattle breeders (*Bos taurus*, Linnaeus, 1758). Three main agro-ecological zones have been the subject of this work. A pre-established questionnaire was used to record the testimonies of the breeders. In addition to the testimonies, direct observations were made on the farms by our team.

Selection of farms

Eighty-three (83) accessible locations were randomly selected. The farms selected were also willing to provide information on his breeding. Four and three administrative departments were visited respectively in savannah areas (located in the north and centre) and in forest areas (located in the south). Thus, 44 farms were visited and 280 breeders interviewed in the savannah zone and 39 farms with 210 breeders interviewed in the forest area. A total of 83 farms were visited (Table 1).

Table 1: Selection of farms

Savannah area			Forest area		
Departments	NF	NB	Departments	NF	NB
Bouaké	06	70	San-Pedro	24	70
Korhogo	19	70	Soubré	02	70
Sinématiali	09	70	Zuenoula	13	70
M'bengué	10	70			
Total	*44*	*280*	*Total*	*39*	*210*

NF: Number of farms; NB: Number of breeder

Data recording

The information collected from farmers was recorded on cards. Identification of the farming method practised and its characteristics were recorded. Practices studied in this work were livestock systems and mode of reproduction. Characteristics of the herd were the breeds bred, other animal species associated with cattle and the size (number of heads). The different percentages of farms with are the same characteristics were calculated according to the following formula:

$$Percentages = \frac{Number\ of\ breeder\ with\ are\ the\ same\ parameters^{*}}{Total\ number\ of\ breeders}$$

*:Farming method practised and characteristics

Data processing and statistical analysis

A descriptive analysis of the data was performed using IBM SPSS version 25.0 (Chicago, IL; USA). This made it possible to determine the frequencies of different modalities. The chi-squared test ($\chi 2$) and the bilateral Z-test were used to compare frequencies. Frequencies were considered significant at the 5% threshold. Multivariate analyses were also performed using IBM SPSS version 25.0 (Chicago, IL; USA). Multivariate analysis included multiple correspondence factor analysis (AFCM) and hierarchical ascending classification (CAH) according to Ward's method, with Euclidean distance measurement. These analyses were used respectively to discriminate the factors that influence the conduct of cattle farming in the study area and to determine a typology of farms at the survey site.

RESULTS

Type and herd size

The characteristics of Breed of cattle are presented in table 2. In the localities visited, the cattle herd was composed of Zebu, Mere, N'dama, Baoulé and mixed. Two thirds of the farms exploited only either mestizos (33.1%), zebu (28%), Méré (2.9%), Baoulés (0.4%) and N'dama (0.2%). However, 35.5% of breeders had mixed herds consisting of zebu, mestizo, Méré, Baoulés and N'dama. The zebus breed and crossbreeds were the most observed cattle on the farms (P <0.01). Zebus were encountered more particularly in Soubré, a forest area. The department with the highest density of mixed races is San Pedro in the forest zone as well. Farms with heterogeneous numbers, i.e. several breeds at the same time, were encountered in forest and savannah areas. However, the highest percentage was also found in forest areas in Zuénoula (P <0.01). On the other hand, the local breeds which are the Baoulé breed and the N'dama breed had almost disappeared in all farms. Only 1.4% of Korhogo farms in the savannah zone had the Baoulé breed. The N'dama breed was found only in Korhogo and Mbingue, two savannah areas.

Two types of herd management were observed (Table 3). There was community management and individual non-community management. The percentage of farmers using both types of management is roughly equivalent. However, in Korhogo in the savannah area, personal management was 14% higher than community management (P=0.02).

With regard to herd size, no breeder has established the structure of his herd. For this purpose, none of the breeders knew the exact number of animals in the herd or some of them considered this information confidential. However, the majority of farms (71.8%) had a herd of less than 100 head of cattle. Those whose herd size was between 100 and 200 heads were three times less numerous (22.9%) than those with less than 100 heads. A minority made up of 5.3% of breeders had a large workforce, the size of which was greater than 200 head of cattle.

Table 2: Breed of cattle according to zone and department

	Savannah area				Forest area			*Probability*	
Cattle breed	Boua	Korh	Siné	Mben	San-P	Soub	Zuen	χ^2	*p-value*
Zebu	18.6^{D}	31.4^{aC}	12.9^{E}	45.7^{B}	7.1^{F}	61.4^{A}	18.6^{bD}	*822*	*0.01*
Mixed	38.6^{B}	31.4^{aE}	37.1^{C}	32.9^{D}	55.7^{A}	10^{G}	25.7^{bF}	*972*	*0.01*
Méré	1.4^{D}	8.6^{cA}	2.9^{C}	0.0	0.0	0.0	7.1^{cB}	*42*	*0.03*
N'dama	0.0	1.4^{b}	0.0	1.4	0.0	0.0	0.0	*2*	*0.16*
Baoulé	0.0	1.4^{b}	0.0	0.0	0.0	0.0	0.0	-	-
Other*	41.4^{C}	25.7^{aF}	47.1^{B}	20.0^{G}	37.1^{D}	28.6^{E}	48.6^{aA}	*1044*	*0.01*
χ^2	*6.93*	*174.64*	*24.64*	*27.80*	*48.95*	*0.69*	*96.53*		
p-value	*0.96*	*0.01*	*0.60*	*0.42*	*0.43*	*0.71*	*0.01*		

Other*: farm containing both zebu, mixed race, méré ; Common : communautary ¸ Boua :Bouaké ; Korh : Korhogo ; Siné : Sinématiali ; Mben : Mbengué ; SanP : San-Pedro ; Soub :Soubré ; Zuen : Zuenoula. $^{a\,b\,c}$ In each column, values with different letters are statistically different (P≤0.05) ; $^{A\,B\,C\,D}$ In each line, values with different letters are statistically different (P≤0.05).

Table 3: Type of herd and size of herds according to zone and department

	Savannah area				Forest area			*Probability*	
	Boua	Korh	Siné	Mben	San-P	Soub	Zuen	χ^2	*p-value*
Type of herd									
Common	47.1^{D}	$42.9^{a.E}$	55.7^{A}	47.7^{D}	51.4^{C}	40.0^{F}	52.9^{B}	*1416*	*0.01*
Uncommon	52.9^{C}	$57.1^{b.B}$	44.3^{F}	52.9^{C}	48.6^{D}	60.0^{A}	47.1^{E}	*1524*	*0.01*
χ^2	*6.35*	*42.37*	*7.09*	*12.34*	*27.63*	*0.47*	*16.82*		
p-value	*0.27*	*0.02*	*0.62*	*0.19*	*0.28*	*0.49*	*0.21*		
Herd size									
<100 head	81.4^{B}	62.9^{F}	$75.7^{a.C}$	64.3^{E}	$92.9^{a.A}$	$71.4^{a.D}$	$54.3^{a.G}$	*2112*	*0.01*
100-200 head	17.1^{E}	32.9^{B}	$17.1^{b.E}$	28.6^{C}	$7.1^{b.F}$	$21.4^{a.D}$	$35.7^{b.A}$	*672*	*0.01*
>200 head	1.4^{D}	4.3^{C}	$7.1^{c.B}$	7.1^{B}	0.0	$7.1^{b.B}$	$10.0^{c.A}$	*130*	*0.01*
χ^2	*10.6*	*50.04*	*38.31*	*20.86*	*39.09*	*29.68*	*50.68*		
p-value	*0.38*	*0.55*	*0.01*	*0.29*	*0.03*	*0.01*	*0.01*		

Common : communautary ¸ Boua :Bouaké ; Korh : Korhogo ; Siné : Sinématiali ; Mben : Mbengué ; SanP : San-Pedro ; Soub :Soubré ; Zuen : Zuenoula. $^{a\,b\,c}$ In each column, values with different letters are statistically different (P≤0.05) ; $^{A\,B\,C\,D}$ In each line, values with different letters are statistically different (P≤0.05).

Cattle farms were associated with other animals (Table 4). These animals were sheep, goats, poultry and pigs. Poultry was the most found in association with cattle in 33.1% of farmers compared to 0.4% for pigs. However, in the savannah zone at MBengué, more sheep were found compared to other animals (P <0.01). As for sheep and goats, they were found in association in 19% and 7.8% of farmers respectively. The pig was encountered only in the forest area in Zuénoula.

Breeding system and mode of reproduction

Two breeding systems were observed in this study (Table 5). They are the transhumant livestock system and the sedentary livestock system. The sedentary system was the most encountered compared to the transhumant system. It was practiced by 79% of breeders against 21% for transhumance. The sedentary livestock system was more practiced in forest areas. The average observed was about 84.3% of farms. Sedentary breeding was more observed in SanPédro iand Zuénoula in forest area (P <0.01). In the departments of San-pedro, Zuénoula and Soubré, sedentary farms represented respectively 94.3%, 82.9% and 75.7%. As for the transhumant livestock system, it was observed more in the savannah areas. It was about 26.7% in this area. In the departments of Bouaké, Korhogo and Sinématiali, the transhumant system represented respectively 30%, 25.7% and 24.3%. Transhumant system was popular in Bouaké compared to other departement (P <0.01).

Table 4: Other animal species associated with cattle

	Savannah area				Forest area			*Probability*	
	Boua	Korh	Siné	Mben	San-P	Soub	Zuen	χ^2	*p-value*
Sheep	25.7^{B}	15.7^{aC}	12.9^{D}	31.4^{aA}	25.7^{B}	8.6^{bE}	12.9^{D}	*558*	*0.01*
Goats	8.6^{C}	5.7^{bE}	15.7^{A}	4.3^{bF}	7.1^{D}	1.4^{bG}	11.4^{B}	*228*	*0.01*
Poultry	44.3^{B}	17.1^{aE}	48.6^{A}	28.6^{aD}	35.7^{C}	35.7^{aC}	21.4^{D}	*972*	*0.01*
Pigs	0.0	0.0	0.0	0.0	0.0	0.0	2.9	-	-
χ^2	*12.7*	*102.9*	*30.9*	*68.1*	*81.4*	*10.1*	*52.1*		
p-value	*0.62*	*0.03*	*0.27*	*0.01*	*0.21*	*0.02*	*0.46*		

Boua :Bouaké ; Korh : Korhogo ; Siné : Sinématiali ; Mben : Mbengué ; SanP : San-Pedro ; Soub :Soubré ; Zuen : Zuenoula. $^{a\,b}$ In each column, values with different letters are statistically different (P≤0.05) ; $^{A\,B\,C\,D}$ In each line, values with different letters are statistically different (P≤0.05).

Natural protrusion was the only mode used. No farm practiced artificial insemination. The breeding was ensured within the herd by the permanent presence of bulls. Unorganized natural mounting was used by the majority of breeders (74.9%) and only a minority (25.1%) controlled the reproduction of their herd by practicing the castration of their animals. Unorganized natural mounting was more observed in Mbengué and San Pédro in 83% of cases (P<0.01). However, controlled mode was more popular in Korhogo compared to other departments (P<0.01).

Table 5: Livestock systems and mode of reproduction according to agro-ecological zone

	Savannah area				Forest area			*Probability*	
	Boua	Korh	Siné	Mben	San-P	Soub	Zuen	χ^2	*p-value*
Breeding system									
Sedentary	$70,0^{F}$	$74,3^{E}$	$75,7^{D}$	$80,0^{C}$	$94,3^{A}$	$75,7^{D}$	$82,9^{B}$	*2322*	*0,01*
Transhumant	$30,0^{A}$	$25,7^{B}$	$24,3^{C}$	$20,0^{D}$	$5,7^{F}$	$24,3^{C}$	$17,1^{E}$	*618*	*0,01*
χ^2	*4,52*	*25,47*	*5,56*	*9,14*	*34,43*	*0,54*	*12,16*		
p-value	*0,48*	*0,49*	*0,78*	*0,43*	*0,08*	*0,46*	*0,52*		
Mode of reproduction									
Free	$67,1^{D}$	$52,4^{E}$	$77,1^{B}$	$82,9^{A}$	$82,9^{A}$	$75,7^{C}$	$67,1^{D}$	*2202*	*0,01*
Controlled	$32,9^{B}$	$47,6^{A}$	$22,9^{D}$	$17,1^{E}$	$17,1^{E}$	$24,3^{C}$	$32,9^{B}$	*738*	*0,01*
χ^2	*5,41*	*26,85*	*9,69*	*11,70*	*30,10*	*0,54*	*10,31*		
p-value	*0,37*	*0,42*	*0,37*	*0,23*	*0,18*	*0,46*	*0,67*		

Boua: Bouaké; Korh : Korhogo ; Siné : Sinématiali ; Mben : Mbengué ; SanP : San-Pedro ; Soub :Soubré ; Zuen : Zuenoula. $^{a\,b}$ In each column, values with different letters are statistically different (P≤0.05) ; $^{A\,B\,C\,D}$ In each line, values with different letters are statistically different (P≤0.05).

DISCUSSION

The Ivorian people do not have a pastoral tradition. Very few Ivorians therefore invest in this sector of activity (Akossoua, 2019). The majority of livestock farmers are said to be mainly immigrants, who are often illiterate. This limits their ability to adapt more rational livestock systems. It also hinders improving livestock productivity (Yao, 2019). Local cattle farmers are poorly informed about opportunities in this sector. Livestock farming is therefore not professionalized or specialized and is a secondary activity for two-thirds of breeders. The breeding of Côte d'Ivoire cattle makes it possible to diversify the resources of rural populations. It's one of many integrated and complementary activities of the Farmer System. Thus, in addition to cattle, farmers also practice other types of livestock such as poultry farming, porciculture and small ruminants. Cattle breeding is most often associated with other speculations. In one third of cases, cattle farming is associated with poultry farming. The strong association of poultry farming, often traditional in Côte d'Ivoire, is generally linked to its importance in the ritual and social life of populations in peasant environments (Soro *et al*., 2015). However, livestock farming still tends to develop with sedentarization despite the persistence of transhumance during the dry season. This short transhumance is caused by difficult environmental conditions. These conditions are marked by insufficient grazing in the dry season and the shortage of drinking water. The lack of pasture is mainly related to recurrent fires in some places, particularly in the savannah area. The sedentarization of livestock is very marked in the localities of the forest zone. This almost forced sedentarization is caused by the reduction of pastoral space because of crops. Sedentarization becomes in these conditions an alternative to stem conflicts between farmers and herders in these areas with high agricultural activities. This solution tends to generalize in Côte d'Ivoire during this last decade. Indeed, the many conflicts observed between herders and farmers, mainly in savannah areas, have pushed the public authorities to encourage sedentary livestock farming. This justifies the high rate of sedentary livestock farmers in savannah and forest areas. In each of the farming systems, performance, profitability or sustainability are based on three main axes. These main axes are the mode and quality of feeding, the mode of reproduction and the health of the animals (Adjou, 2006; Kimsé *et al*., 2017). In breeding, one of the levers for improving performance in cattle is the quality of the bull used. The renewal of bulls would not be systematic within the herd in most farms in Côte d'Ivoire. In addition, most protrusions are carried out in an uncontrolled manner. The renewal of bulls is not systematic within the herd in most farms in Côte d'Ivoire. Breeding is carried out by a selected bull either inside or outside the herd. This mode of reproduction has a negative impact on the fertility of the herd probably because of the inbreeding that could result (Dehoux and Hounsou-ve, 1993). However, it would be possible to control reproduction by castration when animals are raised on natural ranges to avoid inbred coupling.

CONCLUSION

This study characterized cattle farms in savannah and forest areas of Côte d'Ivoire. Cattle breeding is considered a secondary activity. Small farms with less than 100 head were dominant. Two rearing systems were observed. These are mainly the sedentary system and transhumant system. Sedentary livestock farming was the main livestock management

system in savannah and forest areas. However, transhumant breeding was still widespread in the savannah region. Natural mating was used by the majority of breeders. It was done freely without any control with the permanent presence of breeding males in the herd. However, some breeders controlled matings by castration of other males. The animals bred were mainly zebu breeds and mestizos. The latter come from the cross between zebu and local breeds which are Ndama and Baoulé. These local breeds had almost disappeared from the farms. Cattle were often associated with traditional poultry.

FUTURE SCOOP

To better understand the structure of farms in tropical area notably in Côte d'Ivoire, it is necessary to study the other parameters that impact the performance of animals. These are diet, health and reproduction.

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