Cattle breeding practices in lake environments: the case of Benin in West Africa

Ignace Ogoudanan Dotché[1*] Abdou Rachidou Soumanou[1]
Aristide Agbokounou[1,2] Serge G. Ahounou[1]
Karamatou Bio Seydou[1] Foukpê Zhaïrath Adambi Boukari[1]
Pascal Sègbégnon Kiki[1] Issaka Youssao Abdou Karim[1]

Keywords

Cattle, livestock management, feeding systems, lake environment, Benin

OPEN ACCESS

Type: Research article

Submitted: 22 May 2023
Accepted: 12 June 2025
Online: 28 July 2025
DOI: 10.19182/remvt.37162

Summary

Background: Cattle are reared in the lake environment of Benin despite the presence of water. Unfortunately, there is a paucity of information available on breeding practices in this particular environment, impeding efforts to enhance productivity. It is therefore essential to describe the breeding practices used in the lake environment to identify the ones that are the most suitable. ***Aim***: The study aimed to identify the most appropriate cattle rearing practices in the lake environment of Benin. ***Methods***: Data were collected through interviews with 110 cattle farmers in the communes of Sô-Ava and Aguégué. The multiple correspondence analysis was used to identify groups of cattle farmers. These groups were then described and compared using analysis of variance and Fischer test. ***Results***: The data analysis identified three groups of cattle farmers that differed in terms of the type of housing used for livestock, feeding practices, health monitoring methods, difficulties encountered, and ethnic backgrounds. Group 1 consisted of herders using housing on stilts for animals. These herders practice free-range housing with confinement during periods of heavy rain. Animal health is very important to them. Group 2 consisted of herders who have overnight pens marked off on the ground to keep their animals, and who sometimes take care of sick animals. Group 3 consisted of herders who neither provide housing nor treat their animals when they are sick, leading to high livestock mortality rates. The feeding practices are similar in all three groups; however, the confinement of the animals in Group 1 during high water conditions obliges the farmers to distribute fodder and supplements to them. The lack of vaccination of the animals in all three groups leads to diseases on the farms. ***Conclusions***: To improve cattle production in a lake environment, the adoption of the husbandry system used by Group 1 is recommended, along with improving the availability of feed and the systematic vaccination of animals against endemic diseases.

■ How to cite this article: Dotché, I. O., Soumanou, A. R., Agbokounou, A., Ahounou, S. G., Bio Seydou, K., Adambi Boukari, F. Z., Kiki, P. S., & Youssao Abdou Karim, I. (2025). Cattle breeding practices in lake environments: the case of Benin in West Africa. *Revue d'élevage et de médecine vétérinaire des pays tropicaux*, *78*, 37162. https://doi.org/10.19182/remvt.37162

■ INTRODUCTION

The cattle industry plays a pivotal role in the agricultural economies of developing countries, with its contributions extending beyond the production of meat and milk. These include hides, fiber, fertilizer, and fuel, as well as capital accumulation (Upton, 2004; Molina-Flores *et al*., 2020). Globally, cattle produced 69,346,116 tons of meat and 753,320,577 tons of milk in 2022 (FAOSTAT, 2024). Cattle are reared in various systems, including intensive, semi-intensive, and extensive systems (Thewis *et al*., 2005).

While beef production in developed countries is dominated by intensive systems, production in less developed countries, such as those in West Africa, is mostly dominated by extensive systems (Thewis *et al*., 2005; Houessou *et al*., 2019a, 2019b). The extensive systems in developing countries are mainly pastoral and agropastoral (Kosgey *et al*., 2008; Houessou *et al*., 2022). In Benin, the pastoral system is primarily characterized by transhumance, in which animals raised in

1. Department of Animal Production and Health, Laboratory of Animal Biotechnology and Meat Technology, Polytechnic School of Abomey-Calavi, University of Abomey-Calavi, Cotonou, Benin
2. Research Institute for Life Science, Beninese Centre for Scientific Research and Innovation, Cotonou, Benin

* Corresponding author
Phone : +229 0194462368 ; E-mail : dotcheign@gmail.com

the north (in the Sahelian region) move to the south (toward the coast) in search of water and feed during periods of drought and the dry season (Houessou *et al*., 2019a). The northern region has a prolonged dry season and a short rainy season, whereas in the southern region (closer to the coast) there are two rainy seasons and two dry seasons. The multiple rainy seasons in the southern part of the country means that fodder is available year-round (Youssao *et al*., 2020). However, the prevalence of specific diseases, such as trypanosomiasis, is high in this region (Soha *et al*., 2020). Finding fodder is a top priority for livestock farmers. Today, the movement of animals from the north to the south is intensifying due to climate change, which is lengthening the dry season (Idrissou *et al*., 2020). In the agropastoral system, animals are sedentary throughout the year and are fed residues, agricultural by-products, food reserves, and woody fodder during the lean season (Tolera & Abebe, 2007; Ayantunde *et al*., 2011; Franzel *et al*., 2014).

In the southern region of Benin, cattle are raised using an extensive system that allows them to move freely (Tobada *et al*., 2018). This system differs from the one used in the north of the country in terms of farm size, breeds, and the absence of transhumance. In this system, housing is provided in the form of night pens and makeshift wooden structures (Tobada *et al*., 2018). The size of the herd is less than 5 heads in the southern region, while it exceeds 50 heads in the northern region (Houessou *et al*., 2019b, Ahozonlin & Dossa, 2020). The animals are fed through natural grazing. In southern Benin, there are two types of habitats: those built on dry land, and those constructed on stilts over lakes (Dotché *et al*., 2021). Activities in lake environments are primarily focused on fishing (Djenontin, 2006a, 2006b). Unfortunately, this activity cannot cover all household expenses, prompting people to turn to other activities, such as livestock, agriculture, and trade (Dotché *et al*., 2021). Cattle play an important economic role for the local population, allowing farmers to cover their household expenses, pay for their children's school kits, school fees, etc. The presence of water in the environment obliges the farmers to make specific habitats for their animals. The changes in livestock production methods associated with the presence of water have led to diverse production practices, some of which may be more advantageous than others. These changes also make the innovations and techniques developed on dry land inapplicable in this environment. As a result, livestock in lake environments remain vulnerable to various challenges related to feeding, disease, and habitat. Unlike on dry land, forage is aquatic in lake environments. The rainy season causes flooding, which increases the frequency of disease. The dearth of data pertaining to cattle production in lake environments represents a significant impediment to the development of solutions tailored to the specific characteristics of this ecosystem. This study aimed to describe the diverse methods used to rear cattle in lake environments, with the goal of identifying the challenges posed by, and the cattle rearing systems most suited to, these settings.

■ MATERIAL AND METHODS

Study area

Data were collected in the lake communes of Sô-Ava and Aguégués in southern Benin (Figure 1). The commune of Aguégués consists of a cluster of submersible islands of land located in the lower part of the Ouémé River, covering an area of 103 km^2. From July to November, the entire commune is flooded and becomes lacustrine, with the exception of the village of Agbodjèdo. The inhabited area spans 500 m along the Ouémé River and is subject to seasonal flooding during high water periods, when the entire commune becomes lacustrine. There is an equatorial climate in the south with two alternating dry seasons (November to March and mid-July to mid-September) and two rainy seasons (April to mid-July and mid-September to October). The average annual rainfall is 1,200 mm. The soils are hydromorphic with black clay suitable for agriculture. These soils receive annual alluvial deposits during the flood season, which maintains their fertility. The main watercourse that runs through Aguégués is the Ouémé Delta (Djenontin, 2006a). The residents of the Aguégués lake commune are primarily engaged in fishing, agriculture, livestock breeding, and trading (Djenontin, 2006a). The commune has a population of 44,562 inhabitants (INSAE, 2015). The livestock reared in the commune include cattle, pigs, and poultry. In 2022, the estimated number of cattle was 1,358 heads (DSA, 2024). The practice of livestock farming remains traditional, with animals permitted to graze freely during periods of flooding, receiving no maintenance or care. During periods of high-water levels, livestock are confined to family pens, which increases the risk of disease and shortages of feed. The primary crops cultivated in the region are maize, tomatoes, chili peppers, cassava, and sweet potatoes. The total arable land available

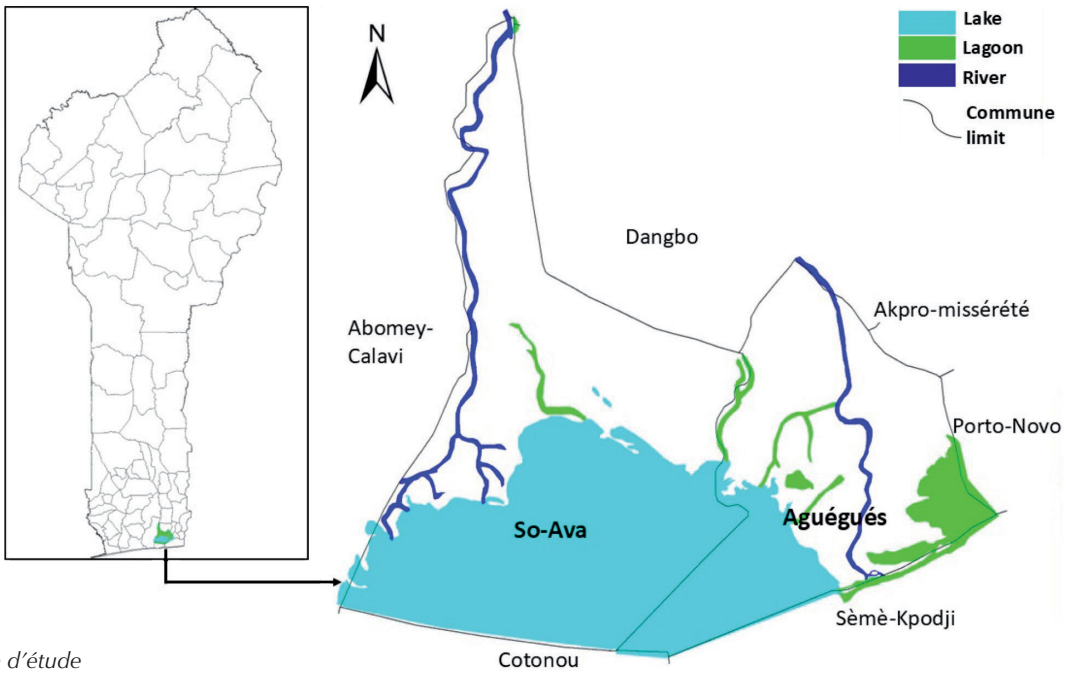

Figure 1: Study area /// *Zone d'étude*

each season is estimated to be 3,000 hectares, with 1,520 hectares allocated to maize, 620 hectares to tomatoes, and 450 hectares to chili peppers (Djenontin, 2006a).

The commune of Sô-Ava is situated at the bottom of the Ouémé and Sô rivers. Its surface area is 218 km², and part of the commune is located on Lake Nokoué. The main rainy season extends from March to July, while the shorter rainy season is from September to November. The average annual rainfall is 1,200 mm. The Sô River runs through Sô-Ava. Its highest flows are observed during floods. The soils consist of sand of marine origin with deep muddy clay and alluvial deposits from the Ouémé valley (Djenontin, 2006b). In terms of economic activity, fishing, agriculture, and livestock breeding represent one set of economic activities, while trade and tourism represent another. These two groups account for 49.44% and 45.07% of the working population, respectively (Djenontin, 2006b). The commune has a population of 118,547 people (INSAE, 2015). The majority of livestock are poultry, goats, cattle, and pigs. The estimated cattle herd size in 2022 was 1,831 head (DSA, 2024). These animals are primarily raised in a free-range system, with a high mortality rate. The primary crops in terms of cultivated acreage are maize, green legumes, groundnuts, tomatoes, okra, cassava, cowpeas, sweet potatoes, and chili peppers (Djenontin 2006b).

Methodology

The data collection methodology used was a retrospective survey involving interviews with cattle farmers. In the absence of a list of the cattle farmers in the locality, we used the snowball method to locate them. An initial list of breeders was obtained from the Territorial Agricultural Development Agency. In total, 110 cattle farmers were ultimately surveyed. Before each interview began, the objective of the study was explained to each individual participant and their consent was obtained. Information was collected using a semi-structured questionnaire. The components of the questionnaire included ethnicity, activities, level of education, marital status, production objectives, breeding methods, difficulties encountered, breeds raised, the size and structure of their cattle herd, method used to build the herd, habitat, diet, health monitoring, and pathologies encountered.

Statistical analysis

The data collected were analyzed using SAS (2013) and R4.0.2 software (Cornillon *et al*. 2018). The MCA function of the FactoMineR Library of R was used for multiple correspondence analysis (MCA) (Cornillon *et al*. 2018). The variables considered for the MCA were ethnicity, housing, breeds reared, types of feed, treatments administered (antibiotics, deworming), pathologies, and difficulties encountered. A hierarchical ascending classification was then conducted based on the characteristics of the farms on the components of the MCA, using the HCPC function (Cornillon *et al*., 2018). Groups of farmers were then identified, with each group corresponding to a specific type of farm.

For quantitative variables, the PROC GLM procedure of SAS (SAS, 2013) was used for the analysis of variance, and the Fischer test was used to assess the significance level of the group factor on the variables considered.

For the qualitative variables, the PROC FREQ procedure of SAS was used to calculate the frequencies, and the Chi² test was used to assess the significance level of the group factor on the variables considered. For each relative frequency, a 95% confidence interval (CI) was calculated using the formula:

$$CI = 1{,}96\sqrt{\frac{[P(1-P)]}{N}}$$

Where P is the relative frequency and N is the sample size.

■ RESULTS

Diversity of cattle breeding systems in the lake environment

Three axes were used to interpret the results of the MCA. These three axes represented 54.89% of the data, with 28.56% on the first axis, 16.71% on the second, and 9.62% on the third. Each axis described a group of farmers, with each group representing a farming system. The results of the MCA presenting the three groups of farms are shown in Figure 2. Group 1 is composed of 45 farmers from the Aguégué commune, Group 2 of 55 farmers from Sô-Ava only, and Group 3 consists of 10 farmers, with one from Aguégués and nine from Sô-Ava.

The first type of livestock system, known as 'stilt-pen' (cluster 1), is practiced by the Goun ethnic group of Aguégué. They raise bulls and have a few zebus in their herds. The animals are housed in enclosures built on stilts (Figure 2). These animals are allowed to graze freely on natural forage during the dry season and when there is no flooding. During periods of flooding, the farmers bring forage to their animals in their enclosures. In addition to this resource, some farmers distribute supplements to their animals. The farmers also treat sick animals and deworm them. Production in this type of farming is affected negatively by diseases (pasteurellosis and uncontrolled infections) and difficulties in accessing fodder during floods.

The second type of livestock system, known as 'night-pen' (cluster 2), is practiced by the Toffin ethnic group in Sô-Ava. The animals are housed in night pens installed on the ground. The animals raised are of the taurine breed. These animals are fed with natural fodder. The farmers treat sick animals and also deworm them. They are confronted with various infectious diseases that are beyond their control, including foot-and-mouth disease. The other difficulties encountered are feeding problems and high mortality rates during the flood period.

The third type of livestock system, known as 'no-housing' (cluster 3), is mainly practiced in Sô-Ava. The herders do not provide their animals housing. These herders only keep taurine breed cattle, and the animals are allowed to graze freely on natural forage without the supervision of herdsmen. This type of livestock system causes conflicts between crop farmers and livestock farmers. Sick animals are not treated, and pathologies are frequent on the farms.

The majority of respondents (92.7%) were men. Most of these herders dropped out of school (97.3%) and are married (99.1%). The others

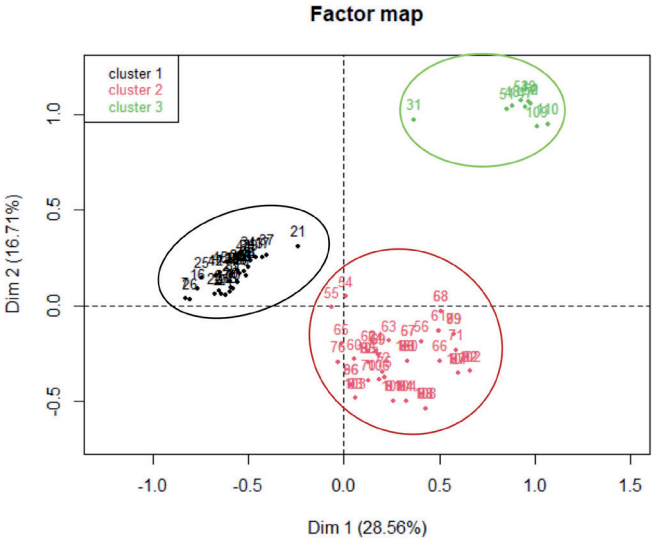

Figure 2: Typology of cattle farms in lake areas in Benin /// *Typologie des élevages bovins en zone lacustre au Bénin*

had primary, secondary, and university levels of education. The level of education did not vary across groups. The majority of respondents were Christian (87.3%) and belonged to the Toffin (58.2%) and Goun (41.8%) ethnicities. The proportions of Toffins in the night-pen (100%) and no-housing (90%) system groups were significantly higher ($p < 0.001$) than in the stilt-pen system group (0%). In contrast, the proportion of Goun herders in the stilt-pen system group (100%) was higher ($p < 0.001$) than in the no-housing system group (10%). The majority of cattle farmers engaged in fishing (71.82%) as their main activity. The farmers in the night-pen (90.91%) and stilt-pen (60%) groups practiced this activity more ($p < 0.001$) than those in the no-housing group (20%). Group 1 and Group 2 farmers, in addition to fishing, engage in agriculture and trade as secondary activities. The plant species cultivated were chili peppers, maize, and manioc. There were no notable differences between the groups with regard to the aforementioned crops.

Herd structure

Table I shows the structure of the herds. The number of animals per age category did not vary significantly between groups. The total herd size was 8.4 cattle on the stilt-pen farms, 7.9 cattle on the night-pen farms, and 8.6 on the no-housing farms. The number of cows per farm was 4 in Group 1, 3.5 in Group 2, and 2.9 in Group 3. Each farm had one bull, irrespective of the group.

Genetic types, production objectives and herd constitution

All of the farms surveyed had bulls of the Lagune breed. Some farmers with stilt pens (6.7%) had Borgou bulls. In addition to these bulls, some of the farmers with stilt pens (8.9%) kept zebus of the M'broro, Gudali, and White Fulani breeds on their farms (Table II). The primary production objective for most respondents was to raise animals for sale (96.4%). In addition to this objective, Group 1 farmers (stilt-pen) were more likely ($p < 0.05$) to aim for meat production. To establish their herds, all of the farmers (100%) purchased the animals. As indicated in the farmers' declarations, the sale price of a Lagune breed animal is estimated to range between 100,000 CFA francs (equivalent to €152) and 150,000 CFA francs (equivalent to €228). The selling price does not depend on the group in question. At the time of sale, the animals are not subjected to a weighing procedure. The price is negotiated between the farmer and the butcher. When an animal is sold, the farmer making the sale must inform other cattle farmers and have them verify the animal's ownership. This is necessary because the animals graze freely without any supervision. The other methods of acquiring animals were donation, entrustment, and inheritance (Table II).

Animal housing in the lake environment in southern Benin

The farms did not have conventional housing structures for the animals (Table III). The animals were housed in ground-based night pens (48.2%) and stilted pens (43.6%). The night pens were only used on Group 2 farms. The stilt pens are made of wooden stilts (Figure 2) and floors of piled grass. The proportion of farmers in Group 1 (96.4%) who house animals in stilt pens (Figure 3) was significantly higher ($p<0.001$) than those in Groups 2 (3.6%) and 3 (10%). Most farmers in Group 3 (90%) had neither a night pen nor a stilted pen to house their animals, and animals were confined or staked during the flood period.

Feeding and watering practices in lake environments

All of the farmers used forage to feed their cattle. A minority of stilt-pen farms (11.1%) gave feed supplements to their animals (Table IV). The farmers were unaware of the type of forage consumed by the animals except for the forage given to the animals during flood periods, namely *Pennisetum sp*. and *Panicum maximum*. The animals on all farms were free to graze forage without a herder present (Figure 4). On the other hand, 42.7% of the farmers distributed forage to the animals (Figure 5). The percentage of farmers with stilt pens (100%) who distributed forage to animals was significantly higher ($p < 0.001$) than the other two groups. The farmers did not store forage due to the year-round availability of the resource in the region (Table IV). Other reasons for the absence of forage storage were a lack of knowledge about appropriate forage conservation techniques, a lack of training,

Figure 3: Cattle enclosure in a lake environment in southern Benin /// *Enclos à bétail en environnement lacustre au sud du Bénin*

Table I: Herd structure of the three forms of cattle breeding in the lake areas of southern Benin /// *Structure des troupeaux des trois formes d'élevage bovin dans les zones lacustres du sud du Bénin*

Variable	Stilt-pen system (n=45)		Night-pen system (n=55)		No-housing system housing (n=10)		ANOVA
	Average	SD	Average	SD	Average	SD	
Calf (0-12 months)	1.6	2.7	2.6	2.3	2.1	2.5	NS
Young bull (12 -36 months)	0.9	1.7	0.5	0.9	1.2	1.6	NS
Heifer (12 -36 months)	1.4	2.1	0.9	1.4	1.6	1.6	NS
Taurus (≥ 36 months)	0.5	1	0.4	0.8	0.8	0.9	NS
Cow (≥ 36 months)	4	3.8	3.5	2.7	2.9	2	NS
Total	8.4	2.2	7.9	1.7	8.6	3.2	NS

NS: Not significant; SD: Standard deviation

and an environment that was not conducive to silage and hay production. The animals drank from the river.

Reproduction of animals in the lake environment

The reproduction of cattle in the lake environment occurred naturally and in an uncontrolled way on all of the farms. The farmers did not introduce new bulls to ensure reproduction in their herds, nor did they use male castration to control inbreeding.

Sanitary management of cattle farms in lake environments

The majority of the farmers treated their animals (67.3%) (Table V). No farmers in Group 3 (no-housing) treated sick animals. The proportion of individuals who treated animals on stilt-pen farms (97.8%) was significantly higher ($p < 0.05$) than those on night-pen farms (54.6%). The majority of respondents (91.8%) also took measures to

Table II: Genetic types of breed, production objectives, and herd constitution in the lake environment in southern Benin /// *Types génétiques des animaux, objectifs de production et constitution du troupeau en milieu lacustre au sud du Bénin*

Variable	General (n=110)		Stilt-pen system (n=45)		Night-pen system (n=55)		No-housing system (n=10)		Chi²
	%	IC	%	IC	%	IC	%	IC	
Genetic type reared									
Taurins	100a	0	100a	0	100a	0	100a	0	NS
Zebu	3.6b	3.5	8.9a	8.3	0b	0	0ab	0	*
Taurine breeds reared									
Borgou	2.7b	3	6.7a	7.3	0a	0	0a	0	NS
Lagune	100a	0	100a	0	100a	0	100a	0	NS
Production objective									
Meat	50a	9.3	73.3a	12.9	34.6b	12.6	30b	28.4	***
Produce animals for sale	96.4a	3.5	91.1b	8.3	100a	0	100ab	0	*
Methods of constituting the herd									
Purchase	100a	0	100a	0	100a	0	100a	0	NS
Gift	10.9d	5.8	4.4b	5.9	18.2a	10.2	0b	0	*
Entrustment	46.4b	9.3	33.3a	13.8	54.6a	13.2	60a	30.4	NS
Inheritance	32.7c	8.8	28.9a	13.2	32.7a	12.4	50a	31	NS
Activities									
Breeding	100a	0	100a	0	100a	0	100a	0	NS
Public employee	0.91e	1.77	2.22a	4.31	0a	0	0a		NS
Agriculture	36.36c	8.99	42.22a	14.43	30.91a	12.21	40a	30.36	NS
Trade	5.45d	4.24	6.67a	7.29	3.64a	4.95	10a	18.59	NS
Fishing	71.82b	8.41	60b	14.31	90.91a	7.60	20c	24.79	**
Transportation	11.82d	6.03	13.33	9.93	12.73	8.81	0	0	NS

CI: Confidence Interval; NS: p> 0.05; **: p< 0.01; ***: p< 0.001; [a,b,c,d] : percentages in the same row followed by different letters differ significantly at the 5% threshold (the difference between groups) and intra-class percentages in the same column followed by different letters differ significantly at the 5% threshold (for the general) /// *CI : Intervalle de Confiance ; NS : p> 0.05 ; ** : p< 0.01 ; *** : p< 0.001 ; a,b,c,d : les pourcentages dans une même ligne suivis de lettres différentes diffèrent significativement au seuil de 5% (la différence entre les groupes) et les pourcentages intra-classe dans une même colonne suivis de lettres différentes diffèrent significativement au seuil de 5% (pour le général)*

Table III: Housing of animals in the lake environment in southern Benin /// *Logement des animaux en milieu lacustre au sud du Bénin*

Variable	General (n=110)		Stilt-pen system (n=45)		Night-pen system (n=55)		No-housing system (n=10)		Chi²
	%	IC	%	IC	%	IC	%	IC	
Night park built on the ground	48.2a	9.3	0 b	0	96.4a	4.9	0 b	0	***
Enclosure built on stilts	43.6a	9.3	100a	0	3.6 b	4.9	10 b	18.6	***
Without housing	8.2 b	5.1	0 b	0	0 b	0	90a	0	**

CI: Confidence Interval; NS: p> 0.05; **: p< 0.01; ***: p< 0.001 ;[a,b,c,d] : percentages in the same row followed by different letters differ significantly at the 5% threshold (the difference between groups) and intra-class percentages in the same column followed by different letters differ significantly at the 5% threshold (for the general) /// *CI : Intervalle de Confiance ; NS : p> 0.05 ; ** : p< 0.01 ; *** : p< 0.001 ; a,b,c,d : les pourcentages dans une même ligne suivis de lettres différentes diffèrent significativement au seuil de 5% (la différence entre les groupes) et les pourcentages intra-classe dans une même colonne suivis de lettres différentes diffèrent significativement au seuil de 5% (pour le général)*

Figure 4: Livestock feeding in a lake environment in Benin /// *Alimentation du bétail en milieu lacustre au Bénin*

protect their animals against external parasites. The proportion of farmers in Group 1 (100%) who treated their animals against ectoparasites was significantly higher ($p<0.05$) than those with a night pen on the ground (90.9%). Similarly, the proportion of farms with a night pen on the ground (90.9%) that controlled external parasites was significantly higher ($p<0.05$) than that of farms without housing. Internal deworming was less common (64.6%) than external deworming on the farms. The majority of the surveyed farms (92.11%) did not vaccinate their animals. A small proportion (8.2%) of the stilt-pen and night-pen farms vaccinated animals against bovine pasteurellosis.

Most of the diseases encountered by the farmers (72.3%) were pathologies that they could not identify on their own. None of the farmers without housing were able to identify the diseases afflicting

Figure 5: Forages collected and distributed to cattle on lake farms in Benin /// *Fourrages collectés et distribués aux bovins dans les fermes lacustres du Bénin*

Table IV: *Animal feeding in the lake environment in southern Benin /// Alimentation animale en milieu lacustre au sud du Bénin*

Variable	General (n=110)		Stilt-pen system (n=45)		Night-pen system (n=55)		No-housing system (n=10)		Chi²
	%	CI	%	CI	%	CI	%	CI	
Types of feed									
Forage	100a	0	100a	0	100a	0	100a	0	NS
Feed supplement	4.6b	3.9	11.1a	9.2	0 b	0	0ab	0	*
Type of forages									
Panicum maximum	100a	0	100a	0	100a	0	100a	0	NS
Pennisetum sp	100a	0	100a	0	100a	0	100a	0	NS
Mode of exploitationof the forage									
Free grazing	100a	0	100a	0	100a	0	100a	0	NS
Distribute to animals	42.7b	9.2	100a	0	1.8 b	3.5	10 b	18.6	***
Practice of forage storage									
No	100	0	100a	0	100a	0	100a	0	NS
Reason for not practicing forage conservation									
Forage availability	73.6a	8.2	64.4 b	13.9	80a	10.6	100a	0	NS
No knowledge of the technique	17.3b	7.1	20a	11.7	15.4a	9.5	0a	0	NS
Lack of training	11.8b	6	15.6a	10.6	9.3a	7.7	0a	0	NS
Unsuitable environment	1.8c	2.5	4.4a	5.9	0a	0	0a	0	NS

CI: Confidence Interval; NS: $p> 0.05$; *: $p< 0.05$; ***: $p< 0.001$; ^{a,b,c,d} : percentages in the same row followed by different letters differ significantly at the 5% threshold (the difference between groups) and intra-class percentages in the same column followed by different letters differ significantly at the 5% threshold (for the general) /// *CI : Intervalle de Confiance ; NS : p> 0.05 ; ** : p< 0.01 ; *** : p< 0.001 ; a,b,c,d : les pourcentages dans une même ligne suivis de lettres différentes diffèrent significativement au seuil de 5% (la différence entre les groupes) et les pourcentages intra-classe dans une même colonne suivis de lettres différentes diffèrent significativement au seuil de 5% (pour le général)*

their animals. In addition to unidentified diseases, the farmers in Group 1 noted pasteurellosis as the most frequently encountered disease, while those in Group 2 more often dealt with foot-and-mouth disease. These diseases were more prevalent during the rainy season, especially during the floods in Group 1 (Table V).

For the treatment of the animals, all of the farmers (100%) used modern medicine. The treatment was performed by the farmers (98.2%) themselves. Veterinarians treated more animals on stilt-pen farms (46.7%) and night-pen farms (50.9%) (Table V).

Challenges encountered in lake environment farms

The lack of feed (71.8%) during flood periods, a lack of veterinary care (59.1%), and high mortality during flood periods (53.6%) were the major challenges highlighted by the farmers. Other challenges included limited grazing space (29.1%), conflicts with crop farmers (19.1%), and a lack of housing (8.2%) for the animals. Problems related to veterinary care and lack of housing were reported more ($p<0.05$) on farms with night pens and farms without housing than on farms with stilt pens (Table VI). On the other hand, feeding difficulties during floods were reported more ($p<0.05$) on stilt-pen farms than on the other two types of farms. The limited grazing space and conflicts between livestock farmers and crop farmers were reported more on farms with night pens than on the other two types (Table VI).

■ DISCUSSION

Status of the breeders, breeds raised, production objectives and method of constitution of the herd

The high proportion of married, uneducated men observed in this study conducted in the lake environment is consistent with previously reported findings regarding cattle farms on dry land in Benin (Youssao *et al*., 2013; Tobada *et al*., 2018). The majority of respondents in our study area practice Christianity, which is related to the ethnic backgrounds of the respondents. In northern Benin, where most herders belong to the Peulh ethnic group, Islam is the most widely practiced religion (Youssao *et al*., 2013).

In this study, the Lagune breed is the most prevalent, as it is particularly well-suited to the environmental conditions present in this area (Tobada *et al*., 2018). Tsetse flies, which are vectors for the transmission of trypanosomosis, proliferate in lake environments. Consequently, a trypanotolerant breed such as the Lagune breed is required in this region. The Lagune breed is characterized by a small stature and a white or black coat color (Ahozonlin *et al*., 2020). The height at the withers is 123 cm, with a body length of 138 cm (Ahozonlin *et al*., 2020).

The primary objective of cattle farmers in lake environments is meat production, as reported by Youssao *et al*. (2013) on cattle farms in

Table V: Animal health practices, main animal diseases and epidemiological risk periods in the lake environment of southern Benin /// *Pratiques de santé animale, principales maladies animales et périodes à risque épidémiologique en milieu lacustre au sud du Bénin*

Variable	General			Stilt-pen system			Night-pen system			No-housing system			Chi²
	N	%	CI	N	%	CI	N	%	CI	N	%	CI	
Treatment of sick animals													
Yes	110	67.3a	8.8	45	97.8a	4.3	55	54.6b	13.2	10	0c	0	***
No	110	32.7 b	8.8	45	2.2c	4.3	55	45.4b	13.2	10	100a	0	***
Deworming of animals													
Ectoparasite	110	91.8a	5.1	45	100a	0	55	90.9b	7.6	10	60c	30.4	***
Endoparasite	110	64.6 b	8.9	45	71.1a	13.2	55	63.6a	12.7	10	40a	30.4	NS
Vaccination of animals													
Yes	110	8.2 b	5.1	45	13.3a	9.9	55	5.4a	5.1	10	0a	0	NS
No	110	91.8a	5.1	45	86.7a	9.9	55	94.6a	5.1	10	100a	0	NS
Person in charge of modern treatments													
Veterinarian	110	48.2 b	9.3	45	46.7a	14.6	55	50.9a	13.2	10	0 b	0	*
Herder	110	98.2a	2.5	45	95.6a	6.0	55	100a	0	10	100a	0	NS
Pathologies encountered													
Pasteurellosis	77	13c	7.2	25	36a	18.8	45	2.2b	4.23	10	0 b	0	***
Trypanosomiasis	77	5.2c	5	25	8a	10.6	45	4.4a	6	10	0a	0	NS
Foot-and-mouth disease	77	26 b	9.8	25	8 b	10.6	45	40a	14.3	10	0 b	0	**
Unknown pathologies	77	72.3a	10	25	68 b	18.3	45	64.4b	14	10	100a	0	*
Diarrhea	77	11.7c	7.2	25	8a	10.6	45	15.6a	10.6	10	0	0	NS
Periods of high disease frequency													
Rainy season	77	63.6a	10.7	25	64a	18.8	45	64.4a	14	10	57.1a	30.7	NS
Dry season	77	40.3 b	11	25	20 b	15.7	45	48.9a	14.6	10	57.1a	30.7	*
Flood period	77	40.3 b	11	25	64a	18.8	45	26.7b	12.9	10	42.9ab	30.7	**

CI: Confidence Interval; NS: p> 0.05; *: p< 0.05; ** : p< 0.01; ***: p< 0.001;a,b,c,d : percentages in the same row followed by different letters differ significantly at the 5% threshold (the difference between groups) and intra-class percentages in the same column followed by different letters differ significantly at the 5% threshold (for the general) /// *CI : Intervalle de Confiance ; NS : p> 0.05 ; ** : p< 0.01 ; *** : p< 0.001 ; a,b,c,d : les pourcentages dans une même ligne suivis de lettres différentes diffèrent significativement au seuil de 5% (la différence entre les groupes) et les pourcentages intra-classe dans une même colonne suivis de lettres différentes diffèrent significativement au seuil de 5% (pour le général)*

Table VI: Main constraints encountered in cattle husbandry in the lake environment in southern Benin /// *Contraintes principales rencontrées dans l'élevage bovin en milieu lacustre au sud du Bénin*

Variable	General (n=110)		Stilt-pen system (n=45)		Night-pen system (n=55)		No-housing system (n=10)		Chi²
	%	CI	%	CI	%	CI	%	CI	
High mortality during flooding	53.6 b	9.3	46.7a	14.6	58.2a	13.0	60a	30.4	NS
Insufficient food during flooding	71.8a	8.4	84.4a	10.6	65.4b	12.6	50b	31	***
Insufficient veterinary care	59.1ab	9.2	44.4 b	14.5	69.1ab	12.2	70a	28.4	*
Lack of housing	8.2d	5.1	0 b	0	14.6a	9.3	10ab	18.6	*
Conflict with farmers	19.1c	7.4	0 b	0	38.2a	12.8	0 b	0	***
Less available grazing space	29.1c	8.5	0 b	0	54.6a	13.2	20 b	24.8	***

CI: Confidence Interval; NS: p> 0.05; *: p< 0.05; ***: p< 0.001;[a,b,c,d] : percentages in the same row followed by different letters differ significantly at the 5% threshold (the difference between groups) and intra-class percentages in the same column followed by different letters differ significantly at the 5% threshold (for the general) /// *CI : Intervalle de Confiance ; NS : p> 0.05 ; ** : p< 0.01 ; *** : p< 0.001 ; a,b,c,d : les pourcentages dans une même ligne suivis de lettres différentes diffèrent significativement au seuil de 5% (la différence entre les groupes) et les pourcentages intra-classe dans une même colonne suivis de lettres différentes diffèrent significativement au seuil de 5% (pour le général)*

Benin. However, this is not the predominant objective on most farms in Benin, where milk production is the primary focus (Kassa *et al*., 2016). It is notable that none of the farmers produce milk, which may be attributed to the Lagune breed's inherent low milk production (Kassa *et al*., 2016). The mean daily milk production of this breed, excluding the quantity consumed by the calf, is 0.36 liters, resulting in a total production of 110.67 liters over the course of an 11-month lactation period (Kassa *et al*., 2016). While the milk production of the Lagune is low, the quality of its meat is very high (Salifou, 2013), which would facilitate its marketing. The Lagune's low productivity may be attributed to the breed's genetic background, because the amount of meat it produces is also low (Salifou, 2013). Under traditional conditions, the mean birth weight of Lagune breed calves is approximately 10 kg, with a mean weight at six months of 40 kg (Ahozonlin & Dossa, 2022). The slaughter weight of the animal at five years of age is 142 kg, with a carcass yield of 57% (Salifou, 2013). In a controlled environment, the mean birth weight of Lagune breed calves is 10 kg, with adults weighing between 140 and 150 kg (table VII). To improve the meat production of this breed, some farmers who have habitats for their animals introduce zebus into their farms. This practice, already reported in Zou by Youssao *et al*. (2020), is important for this group of farmers, as it can allow them to recover the money invested in the construction of the animals' habitat. In addition to genetic factors, the farmers' lack of proficiency in milking techniques and the lack of housing to separate calves from cows could also explain their difficulty in exploiting milk.

Housing and feeding of animals

The absence of housing on Group 3 farms and the use of night pens on Group 2 farms are not adapted to this environment. The presence of water during the rainy season exposes the animals to a range of water-borne diseases and parasites. The pens identified in this study differ from the traditional parks used by herders in Benin, which are bordered by woods (Houessou *et al*., 2019b). The night pens identified in this study are areas reserved by farmers for keeping animals at night and for the administration of veterinary treatments. The stilt pens used by Group 1 appear to be the most suitable housing for animals because they prevent contact between the animals and the river water.

When the animals must be confined in the stilt pens, their access to forage is reduced. As a result, farmers are forced to search for forage in the wild to give to their animals. As these farmers do not store forage, they must harvest it every day, which can be difficult for them. The main reasons that they do not store forage are the abundance of available forage and a lack of knowledge about conservation techniques. The authorities in charge of livestock could assist farmers in managing technical difficulties. The presence of water means that certain standard methods of feed conservation like silage cannot be

Table VII: Zootechnical performance of Lagune cattle in Benin /// *Performances zootechniques des bovins de race Lagune au Bénin*

Parameters	Value	Authors
Birth weight (kg)	13.44 (F)-15.37 (M)*	Gbangboché *et al.* (2011)
	10.4-10.6	Ahozonlin & Dossa (2022)
Weight at 6 months (kg)	39.1 -40.7	Ahozonlin & Dossa (2022)
Weaning weight (kg)	91.97-93.01	Gbangboché *et al.* (2011)
Adult weight (kg)	100 –200*	Alkoiret & Gbangboché (2005)
Slaughter weight (kg)	142.30	Salifou (2013)
Average daily gain (g/d)	182.05 (F)- 185.28 (M)*	Gbangboché *et al.* (2011)
Carcass yield (%)	48.59	Salifou (2013)
Average age at first calving (days)	1 373*	Alkoiret & Gbangboché (2005)
Calving interval (days)	426*	Alkoiret & Gbangboché (2005)
Parturition rate (%)	74.3	Ahozonlin & Dossa (2022)
Fecundity rate (%)	77	Ahozonlin & Dossa (2022)
Milk production per day (liter)	0.36*	Kassa *et al.* (2016)

* Data from improved breeding, F: Female, M: Male /// * *Données provenant d'un élevage amélioré, F : femelle, M : mâle*

applied because silage in Benin is made in an anaerobic environment in pits dug in the ground (Youssao, 2015). The conservation method applicable in this environment is hay making (Horrocks & Valentine, 1999; Haselmann *et al*., 2020) with some adaptations to the technique. The main adaptation is the construction of stilts for haymaking. However, farmers could practice bale silage, which would require qualified personnel.

On Group 2 and Group 3 farms, farmers do not harvest forage because their animals are allowed to range freely. This practice saves herders time but exposes animals to health problems that can lead to mortality (Ahozonlin & Dossa, 2022). The absence of a guard for free-range animals means that animals from different farms mingle together, especially in Group 3. Consequently, whenever herders decide to sell an animal, they must first provide proof of ownership. This difficulty can be overcome by identifying the animals with tags.

Reproductive management and health monitoring

Mating occurs naturally and without intervention, as already reported in Benin's dryland cattle farms (Youssao *et al*., 2013). However, the animals' unguarded freedom of movement and the absence of housing in Group 3 farms could increase the risk of inbreeding (Thewis *et al*., 2005). As a result, related animals can mate freely in the village. Inbreeding has negative consequences on animal performance (Jussiau *et al*., 2013) and should be avoided in lake environments. The castration of males of reproductive age to reduce inbreeding on dryland farms (Youssao, 2015) appears to be less effective in lake environments. This is because the different herds are mixed in the pastures, and the herders do not castrate all bulls. Restricting the movement of animals in confined farms by housing males and females separately can help reduce the risk of inbreeding.

The type of housing influences the decision of whether or not to treat the animals. The better the housing, the more importance the farmers attach to monitoring their animals' health. Farms without housing (Group 3) do not prioritize animal health. The lack of care given to the animals could explain the high mortality registered in this system. In fact, in this environment characterized by a strong presence of water, there is a significant proliferation of microbes and vectors, which can increase pathologies in the farms (Dotché *et al*., 2021). Treating and especially vaccinating animals is crucial in lake environments where water is prevalent, as water can easily carry microbes from free-range farms to confined farms.

However, vaccination is almost non-existent, posing a threat to herd viability and income, especially on the farms without housing, because diseases such as pasteurellosis and CBPP are still rampant in Benin (Noudèkè *et al*., 2017). In the lake environment, it is essential to implement systematic vaccination against local infectious diseases, as water can play a significant role in the dissemination of microbial agents. The case of the Benin lake livestock could be explained by the lack of veterinarians, as pointed out by the farmers in Group 3. The absence of vaccination could explain the high presence of diseases on lake farms. However, the lack of knowledge about the diseases recorded does not allow them to be associated with infectious diseases that can be prevented by vaccination.

Main constraints encountered

The majority of farmers were confronted with the problem of insufficient feed during the flood period, as this is when animals are kept in pens (Groups 1 and 2), thus leading farmers to search for forage to feed their animals. This problem of feed resource availability has also been reported in dryland farms (Azalou *et al*., 2019; Houessou *et al*., 2020; Youssao *et al*., 2020). However, in contrast to dryland farms, where feed availability is limited by crops (Houessou *et al*., 2020), lake farms face limitations due to the presence of water. The advantage of lake environments is the presence of forage during the dry season. This is the reason behind the movement of animals from northern farms to the south, where the lake environments are located (Azalou *et al*., 2019). In this context, the lake farms could shift to dry land during the flood periods. This displacement from the lake environment to dry land offers advantages and disadvantages. One advantage is that it helps preserve herds and increase the number of animals. Herders without proper housing tend to sell their animals when the floods approach. In addition, those who have housing adjust the size of their herd to match the holding capacity of these structures. The main disadvantage is the cessation of fishing during this period. Therefore, herders should consider the profitability of each activity (cattle farming and fishing) to inform their choices during this period (cattle breeding or fishing).

In addition to insufficient feed, farmers also reported insufficient veterinary care, high mortality rates, and conflicts with crop farmers, especially those in Group 3. The reported high mortalities in Group 3 may be associated with the lack of housing and lack of monitoring in this group (Thewis *et al*., 2005). The lack of health care for the animals calls for the intervention of livestock services to strengthen their monitoring program for livestock in this locality. It is important to note that there is a dearth of data pertaining to mortality in lake environments. However, a study conducted in the Ouémé valley, which took into account the lake environment, reported a perinatal mortality rate of 9.7% and a total mortality rate per herd of 6.7% (Ahozonlin & Dossa, 2022). These figures are higher than the rates observed outside the valley, which are 4.2% and 1.7%, respectively (Ahozonlin & Dossa, 2022). These findings substantiate the remarks made by farmers and highlight the elevated mortality rates observed in the lake environment.

■ CONCLUSION

The study showed that three types of cattle rearing are practiced in lake environments. These are cattle breeding with stilt pens (Group 1), cattle breeding with night pens (Group 2), and cattle breeding without housing (Group 3). The specific types of livestock associated with a particular ethnic group are indicative of the cultural and historical influences that shape the practices of herding communities. The Group 1 breeding system is observed among the Toffin, while the Group 2 and 3 systems are observed among the Goun. The Lagune breed, which has been adapted to the local environment, is the primary breed used by cattle farmers. However, the introduction of zebus into Group 1 systems could potentially have a detrimental impact (absorption crossing) on the local breed. Therefore, it is essential to closely monitor the usage of zebus by farmers. The different types of livestock systems exploit the same feed resources, natural forages. The mode of exploitation of these resources is the same in the three types with a slight modification in the stilt-pen farms. In this type, the presence of enclosures obliges the breeders to provide forage to their animals during flood periods. The lack of housing in the Group 3 system increases mortality, especially during the flood period, and causes conflicts with farmers. In addition to these difficulties, breeding in night pens also face problems of access to fodder during flooding. It is evident that sanitary issues (the primary cause of mortality reported by farmers) are observed across all types of farms, despite the implementation of deworming and treatment protocols for animals on some farms. This observation indicates that farms in this region require greater assistance to develop sanitary and biosecurity measures that are adapted to the specific conditions of the area. Taking these difficulties into account, stilt farming with necessary interventions to address feeding and sanitary difficulties is better suited to lake environments.

Acknowledgments

The authors would like to express their gratitude to the cattle breeders residing in the lake areas of Benin for their invaluable collaboration.

Funding

This research received no specific grant from any funding agency in the public, commercial, or not-for-profit sectors.

Conflict of interest

The authors declare no conflict of interest.

Author contributions

IOD, SGA and IYAK: study design and planning; ARS, IOD, PSK and AA: data collection and drafting of the first version of the manuscript; IOD, ARS, KBS, FZAB and: data analysis and interpretation; AA and IYAK: critical revision of the manuscript and editing of the manuscript. All authors read and approved the final version.

Ethics approval

The approval of an ethics committee concerning the use of animals was not necessary for this study, as the data were collected by interviewing the breeders.

Data availability

The data were not deposited in an official repository. The data that support the study findings are available from the authors upon request.

Declaration of Generative AI in the writing process

The authors did not use any artificial intelligence-assisted technologies in the writing process.

REFERENCES

Ahozonlin, M. C., & Dossa, L. H. (2022). Productive and reproductive performances of smallholder West African shorthorn Lagune cattle herds under village conditions in Southern Benin. *Tropical Animal Health and Production*, *54*(2). https://doi.org/10.1007/s11250-022-03137-3

Ahozonlin, M. C., & Dossa, L. H. (2020). Diversity and resilience to Socio-Ecological changes of smallholder lagune cattle farming systems of Benin. *Sustainability*, *12*(18), 7616. https://doi.org/10.3390/su12187616

Ahozonlin, M. C., Dossa, L. H., Dahouda, M., & Gbangboche, A. B. (2019). Morphological divergence in the West African shorthorn Lagune cattle populations from Benin. *Tropical Animal Health and Production*, *52*(2), 803–814. https://doi.org/10.1007/s11250-019-02071-1

Alkoiret, T., & Gbangboche, A. (2005). Fécondité de la vache Lagunaire au Bénin. Age au premier vêlage et intervalle entre vêlages. *Revue d'élevage et de médecine vétérinaire des pays tropicaux*, *58*(1–2), 61. https://doi.org/10.19182/remvt.9941

Ayantunde, A., De Leeuw, J., Turner, M., & Said, M. (2011). Challenges of assessing the sustainability of (agro)-pastoral systems. *Livestock Science*, *139*(1–2), 30–43. https://doi.org/10.1016/j.livsci.2011.03.019

Azalou, M., Seidou, A. A., Assogba, B. G. C., Adjassin, J. S., Worogo, H. S. S., Baco, M. N., & Traoré, I. A. (2019). Calendrier pastoral et carte de transhumance des éleveurs exploitant les ressources pastorales de la commune de Djidja au Sud Bénin. *Revue d'élevage et de médecine vétérinaire des pays tropicaux*, *72*(1), 3–11. https://doi.org/10.19182/remvt.31727

Cornillon, P. A., Guyader, A., Husson, F., Jégou, N., Josse, J., Klutchnikoff, N., Matzner-Lober, E., *et al*. (2018). *R pour la statistique et la science des données*. Presses Universitaires de Rennes. https://pur-editions.fr/product/8090/r-pour-la-statistique-et-la-science-des-donnees

Djenontin I. (2006a). Monographie communale des Aguégués. Programme d'appui au démarrage des communes, Bénin.

Djenontin I. (2006b). Monographie de la commune de So-Ava. Programme d'appui au démarrage des communes, Bénin.

Dotché, I. O., Seydou, K. B., Ahouanse, A. G. G., Tohoun, E., Bankolé, B. C., & Karim, I. Y. A. (2021). Comment concevoir la biosécurité des élevages porcins des milieux lacustres du sud Bénin pour réduire le risque de maintien et de dissémination de la peste porcine africaine ? *Cahiers Agricultures*, *30*, 32. https://doi.org/10.1051/cagri/2021018

DSA. (2024). Cheptel conventionnel. Bénin. https://apidsa.agriculture.gouv.bj/public/storage/uploads/ndoMN6OQBMBqGZdByjBptDm9TvJ86026R-DUSHnCv.xlsx

FAOSTAT. (2024). Cultures et produits animaux. FAO. Consulté le 19 septembre 2024 sur http://www.fao.org/faostat/fr/#data/QCL

Franzel, S., Carsan, S., Lukuyu, B., Sinja, J., & Wambugu, C. (2013). Fodder trees for improving livestock productivity and smallholder livelihoods in Africa. *Current Opinion in Environmental Sustainability*, *6*, 98–103. https://doi.org/10.1016/j.cosust.2013.11.008

Gbangboche, A. B., Alkoiret, T. I., Chrysostome, C. A. A. M., Salifou, S., & Hornick, J. L. (2011). Preweaning growth performance of Lagune cattle in Benin. *International Journal of Livestock Production*, *2*(10), 159-165.

Haselmann, A., Wenter, M., Fuerst-Waltl, B., Zollitsch, W., Zebeli, Q., & Knaus, W. (2020). Comparing the effects of silage and hay from similar parent grass forages on organic dairy cows' feeding behavior, feed intake and performance. *Animal Feed Science and Technology*, *267*, 114560. https://doi.org/10.1016/j.anifeedsci.2020.114560

Horrocks, R. D., & Vallentine, J. F. (1999). Feeding Harvested Forages. In Horrocks, R. D., Vallentine, J. F. (dirs.), *Harvested Forages* (pp. 75–85). https://doi.org/10.1016/b978-012356255-5/50027-4

Houessou, S. O., Dossa, L. H., Diogo, R. V. C., Ahozonlin, M. C., Dahouda, M., & Schlecht, E. (2019). Confronting pastoralists' knowledge of cattle breeds raised in the extensive production systems of Benin with multivariate analyses of morphological traits. *PLoS ONE*, *14*(9), e0222756. https://doi.org/10.1371/journal.pone.0222756

Houessou, S. O., Dossa, L. H., Diogo, R. V., Houinato, M., Buerkert, A., & Schlecht, E. (2018). Change and continuity in traditional cattle farming systems of West African Coast countries: A case study from Benin. *Agricultural Systems*, *168*, 112–122. https://doi.org/10.1016/j.agsy.2018.11.003

Houessou, S., Vanvanhossou, S., Diogo, R., & Dossa, L. (2022). Dynamics of changes in the breed composition of pastoral and agro-pastoral cattle herds in Benin: implications for the sustainable use of indigenous breeds. *Heliyon*, *8*(4), e09229. https://doi.org/10.1016/j.heliyon.2022.e09229

Houessou, S. O., Dossa, L. H., Assogba, C. A., Diogo, R. V. C., Vanvanhossou, S. F. U., & Schlecht, E. (2020). The role of cross-border transhumance in influencing resident herders' cattle husbandry practices and use of genetic resources. *Animal*, *14*(11), 2378–2386. https://doi.org/10.1017/s1751731120001378

Idrissou, Y., Assani, A. S., Baco, M. N., Yabi, A. J., & Traoré, I. A. (2020). Adaptation strategies of cattle farmers in the dry and sub-humid tropical zones of Benin in the context of climate change. *Heliyon*, *6*(7), e04373. https://doi.org/10.1016/j.heliyon.2020.e04373

INSAE. (2015). *Que retenir des effectifs de population en 2013 ?* INSAE, RGPH4. https://instad.bj/images/docs/insae-statistiques/enquetes-recensements/RGPH/1.RGPH_4/TOME%201.pdf

Jussiau, R., Papet, A., Rigal, J., & Zanchi, E. (2013). *Amélioration génétique des animaux d'élevage*. Educagri.

Kassa, S. K., Ahounou, G. S., Dayo, G. K., Salifou, C. F. A., Dotché, O. I., Issifou, T. M., Gandonou, P., *et al*. (2016). Évaluation et modélisation de la production de lait des vaches Girolando, Borgou, Lagunaire et croisées Azawak × Lagunaire, élevées dans le système semi-amélioré au Bénin. *Journal of Applied Biosciences*, *103*, 9829–9840. https://www.ajol.info/index.php/jab/article/view/142458/134268

Kosgey, I., Rowlands, G., Van Arendonk, J., & Baker, R. (2008). Small ruminant production in smallholder and pastoral/extensive farming systems in Kenya. *Small Ruminant Research*, *77*(1), 11–24. https://doi.org/10.1016/j.smallrumres.2008.02.005

Molina-Flores, B., Manzano-Baena, P., & Coulibaly, M. D. (2020). *The role of livestock in food security, poverty reduction and wealth creation in West Africa*. FAO. https://doi.org/10.4060/ca8385en

Noudèkè, N. D., Dotché, I., Ahounou, G. S., Karim, I. Y. A., & Farougou, S. (2017). Inventory of medicinal plants used in the treatment of diseases that limit milk production of cow in Benin. *Journal of Advanced Veterinary and Animal Research*, *4*(1), 1. https://doi.org/10.5455/javar.2017.d183

Salifou, C. F. A. (2013). Evaluation de la composition corporelle et de la qualité de la viande des taureaux Borgou, Lagunaire et Zébu Peulh élevés sur pâturages naturels au Bénin. [Thèse de Doctorat de l'Université d'Abomey-Calavi].

SAS. (2013). Base SAS® 9.4 Procedures Guide: Statistical Procedures, Second Edition.

Soha, A., Dotche, I., Achade, G., Dougnon, J., Karim, I. Y. A., Farougou, S., & Kpodekon, M. (2020). Prevalence of cattle trypanosomosis in slaughterhouses and farms in Benin and impact on hematocrit in cattle. *Journal of Advanced Veterinary and Animal Research*, *7*(1), 6. https://doi.org/10.5455/javar.2020.g387

Thewis, A., Bourbouze, A., Compère, R., Duplan, J.-M., & Hardouin, J. (2005). *Manuel de zootechnie comparée Nord-Sud*. Editions Quae.

Tobada, P. C., Ahounou, S. G., Dotché, O. I., Dilanon, M., Ahokpossi, C., & Youssao, I. A. K. (2018). Caractéristiques de l'élevage des bovins de race lagunaire dans la vallée de l'Ouémé. *Revue Internationale des Sciences Appliquées, 1*, 6–20.

Tolera, A., & Abebe, A. (2007). Livestock production in pastoral and agropastoral production systems of southern Ethiopia. *Livestock Research for Rural Development, 19*(12), https://www.lrrd.cipav.org.co/lrrd19/12/tole19177.htm

Upton, M. (2004). *The role of livestock in economic development and poverty reduction*. PPLPI Working Paper No. 10.

Youssao, A. K. I. (2015). *Programme national d'amélioration génétique*. Projet d'Appui aux Filières Lait et Viande (PAFILAV). PAFILAV. Cotonou, Bénin.

Youssao A.K.I., Dahouda M., Attakpa E.Y., Koutinhouin G.B., Ahounou G.S., Toleba S.S., & Balogoun B.S. (2013). Diversité des systèmes d'élevages de bovins de race bovine Borgou dans la zone soudanienne du Bénin. *International Journal of Biological and Chemical Sciences*, *7*(1), 125-146. https://doi.org/10.4314/ijbcs.v7i1.11

Youssao, I. A. K., Dotché, I. O., Houaga, I., Kassa, K. S., & Alladaye, V. (2020). Phenotypic characterization and temporal evolution of cattle breed diversity in Djidja, Benin. *Journal of Advanced Veterinary Research*, *10*(3), 146–153. https://advetresearch.com/index.php/AVR/article/view/468

Résumé

Dotché I.O., Soumanou A.R., Agbokounou A., Ahounou S.G., Bio Seydou K., Adambi Boukari F.Z., Kiki P.S., Youssao Abdou Karim I.

Pratiques d'élevage bovin en milieu lacustre : le cas du Bénin en Afrique de l'Ouest

Contexte : Dans les zones lacustres du Bénin, l'élevage de bovins persiste malgré la présence d'eau. Néanmoins, les informations disponibles sur les pratiques d'élevage dans cet environnement particulier s'avèrent rares, entravant ainsi les efforts d'amélioration de la productivité. Il est donc essentiel de décrire les pratiques d'élevage utilisées en milieu lacustre afin d'identifier celles qui seraient les plus adaptées. ***Objectif*** : L'étude visait à identifier les pratiques d'élevage les plus appropriées dans l'environnement lacustre du Bénin. ***Méthodes*** : Les données ont été collectées par le biais d'entretiens auprès de 110 éleveurs de bovins dans les communes de Sô-Ava et d'Aguégué. Une analyse des correspondances multiples a été utilisée pour identifier des groupes d'éleveurs. Ces groupes ont ensuite été décrits et comparés à l'aide de l'analyse de variance et du test de Fischer. ***Résultats*** : Trois groupes d'éleveurs ont été identifiés, se distinguant par le type de logement utilisé pour le bétail, les pratiques d'alimentation, les méthodes de suivi sanitaire, les difficultés rencontrées et les origines ethniques. Le groupe 1 était composé d'éleveurs utilisant des logements sur pilotis pour les animaux. Ces éleveurs pratiquent l'élevage en plein air et le confinement pendant les périodes de fortes pluies. La santé des animaux est très importante pour eux. Le groupe 2 est composé d'éleveurs qui disposent d'enclos de nuit délimités au sol pour garder leurs animaux et qui s'occupent parfois des animaux malades. Le groupe 3 est composé d'éleveurs qui ne fournissent pas de logement et ne soignent pas leurs animaux lorsqu'ils sont malades, ce qui entraîne des taux de mortalité élevés. Les pratiques d'alimentation sont similaires dans les trois groupes ; cependant, le confinement des animaux dans le groupe 1 pendant les périodes de montée des eaux oblige les agriculteurs à leur distribuer du fourrage et des compléments. L'absence de vaccination des animaux dans les trois groupes entraîne des maladies dans les exploitations. ***Conclusions*** : Pour améliorer la production bovine en milieu lacustre, il est recommandé d'adopter le système d'élevage utilisé par le groupe 1, en améliorant notamment la disponibilité des aliments et en vaccinant systématiquement les animaux.

Mots-clés: bovin, conduite d'élevage, technique d'alimentation, environnement lacustre, Bénin

Resumen

Dotché I.O., Soumanou A.R., Agbokounou A., Ahounou S.G., Bio Seydou K., Adambi Boukari F.Z., Kiki P.S., Youssao Abdou Karim I.

Prácticas de ganadería bovina en entornos lacustres: el caso de Benín, en África Occidental

Contexto: En las zonas lacustres de Benín la cría de bovinos persiste a pesar de la presencia de agua. Sin embargo, la información disponible sobre las prácticas ganaderas en este medio particular resulta escasa, lo que dificulta los esfuerzos de mejora de la productividad. Es, pues, esencial describir las prácticas ganaderas aplicadas en medio lacustre para identificar las más adaptadas. ***Objetivo***: El estudio pretende identificar las prácticas ganaderas más apropiadas en el medio lacustre de Benín. ***Métodos***: Los datos se recogieron mediante entrevistas a 110 ganaderos de bovinos en las comunas de Sô-Ava i de Aguégués. Se utilizó un análisis de correspondencias múltiples para identificar grupos de ganaderos. A continuación, se describieron estos grupos y se compararon mediante el análisis de varianza y la prueba de Fischer. ***Resultados***: Se identificaron tres grupos de ganaderos, distinguiéndose por el tipo de alojamiento utilizado para el ganado, las prácticas alimentarias, los métodos de seguimiento sanitario, las dificultades encontradas y los orígenes étnicos. El grupo 1 está formado por ganaderos que utilizan establos sobre pilotes para los animales. Estos criadores practican la ganadería al aire libre y el confinamiento durante los períodos de fuertes lluvias. La salud de los animales es muy importante para ellos. El grupo 2 está formado por ganaderos que disponen de corrales para las noches delimitados en el suelo para guardar los animales y que a veces se ocupan de los animales enfermos. El grupo 3 está formado por ganaderos que no proporcionan alojamiento ni curan a sus animales cuando están enfermos, lo que comporta tasas de mortalidad elevadas. Las prácticas alimentarias son similares en los tres grupos, sin embargo, el confinamiento de los animales del grupo 1 durante los períodos de subida de las aguas obliga a los agricultores a proporcionarles forraje y complementos. La ausencia de vacunación de los animales en los tres grupos comporta enfermedades en las explotaciones. ***Conclusiones***: Para mejorar la producción bovina en medio lacustre se recomienda adoptar el sistema de ganadería utilizado por el grupo 1, mejorando especialmente la disponibilidad de alimentos y vacunando sistemáticamente a los animales.

Palabras clave: ganado bovino, manejo del Ganado, sistema de alimentación, ambiente lacustre, Benin