International Journal of Zoology Studies
ISSN: 2455-7269; Impact Factor: RJIF 5.14
Received: 20-07-2020; Accepted: 06-08-2020; Published: 17-08-2020
www.zoologyjournals.com
Volume 5; Issue 4; 2020; Page No. 18-23

Ladoum sheep and its breeding in Senegal

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Abstract
This study was carried out in three regions (Dakar, Thiès and Diourbel) of Senegal in order to characterize the production systems of Ladoum breeding sheep in urban areas of Senegal. Data are collected from 49 herds from a survey which focused on: ethnic distribution of breeders, their socio-professional profiles, methods of ownership of animals, herd size and demographic compositions. The data collected were analyzed using Excel spreadsheet. Results show that the majority (59.2%) of Ladoum sheep breeders belong to the Wolof ethnic group. Most of sheep breeders are involved in activities other than animal husbandry. The majority of herds (94%) are individually owned. The average herd size is 16 ± 11.9 heads with extremes ranging from 3 to 64 individuals. Most of the herds (65.3%) contain more than 10 heads. The majority of the herds are comprised of ewes with an overall percentage of 38.3% of the population, but rams are also present in large numbers (14.2%). The main motivations for rearing Ladoum sheep are: passion, income generation and social functions. The main constraints are health, feeding, theft and housing. Ladoum sheep breeding deserves better attention from public authorities which should capitalize on the experiences of breeders to design development strategies for sheep farming within the framework of the national sheep self-sufficiency program.

Keywords: sheep, ladoum, characterization, farming system

1. Introduction
Livestock sector represent 40% of global agricultural production and contributes to livelihoods and food security of nearly one billion people (FAO, 2009) [8]. It is one of main economic activities in Sahel with a contribution of 30 to 40% to agricultural PIB (*Produit Intérieur Brut*) of countries such as Burkina Faso, Cape Verde, Mali, Mauritania, Niger, Senegal, Sudan and Chad (Mulumba *et al*., 2008) [14]. In Senegal, livestock sub-sector constitutes an essential link in economy through export promotion, jobs creation and meeting food needs of rural and urban populations (Gueye, 2003) [11].
With a contribution to PIB of 4.2% in 2012 (PSE, 2014), livestock sector should be among the sectors driving Senegalese economic growth, thanks to the implementation of the various development strategies planned in this area (ANDS, 2013). Livestock are an essential wealth in Senegal because 68% of Senegalese households own them. In rural areas, 90% of households have herds, while in urban centers this percentage rises to 52% (NISDEL, 2004).
National sheep population is estimated at around 6.6 million heads (ANDS, 2016). It is essentially composed of five exploited breeds: Peul peul, Djallonké, Touabire, Balli Balli, Ladoum and products of their crosses.
Among these, Ladoum, resulting from the selection by the breeders themselves, has indeed become the most popular sheep by Senegalese breeders, due to its large size and its market value (Thior, 2013). According to this same author, the emergence of Ladoum sheep farming, mainly in urban areas, has become a reality and as proof the existence of many breeders'associations everywhere in Senegal.
Thus,urban livestock farming plays a significant socio-economic role in Senegal. It plays many functions including incomes generation, savings, social role, self-consumption, passion, etc. This activity is however also confronted with several constraints such as pathologies, cattle theft, food, housing and animal sale (Fall, 2016; Thior, 2013; Ousseyni, 2011) [7].
However, given the interest shown by the populations in this breed, its uncontrolled emergence and the many problems encountered by Ladoum sheep breeders, a socio-economic and zootechnical study of this breed and its breeding an help to the implementation of an adequate technical framework with breeders and thus for a wide dissemination of the breed which should lead to its sustainability (Cabaraux *et al*., 2013) [4].
The aim of this study is to characterize Ladoum sheep farming system in urban areas of Senegal. This characterization will allow a better understanding of Ladoum sheep breeding and better decision-making for improvement of this activity.

2. Materials and Methods
Study's location
Surveys were conducted in 3 localities (Dakar, Thiès and Diourbel) due to their agro-climatic and ecological characteristics (see Map 1). These localities are among the most representative in the breeding of Ladoum sheep.

Dakar region
Located in Niayes area, it occupies the peninsula of Cape Verde and covers an area of 550 km^2. Dakar is between 17 ° 10 and 17 ° 43 West longitude and 14 ° 53 and 14 ° 35 North latitude. It is located between the 300- and 600-mm

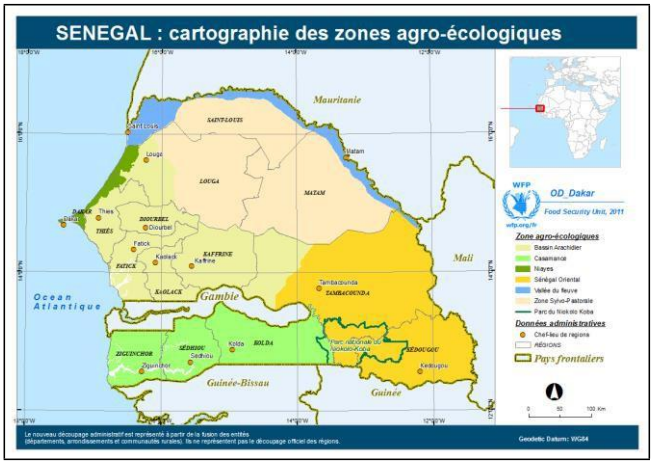
isohyets.

Thiès region

Thies region is located 70 km from the capital of Senegal, Dakar, it is between 16 ° 55 West longitude and 14 ° 47 North latitude. It covers an area of 6,601 km^2. It straddles *Zone des Niayes* and *Bassin arachidier*.

Diourbel region

Located between the isohyets 14 ° 30 and 15 ° North latitude and 15 ° 40 West longitude in the North Center of *Bassin Arachidier*, it covers an area of 4,769 km^2.



(Source: https://reliefweb.int/map/senegal/senegal-cartographie-des-zones-agro-cologiques)

Map 1: Location of the study areas

General information on Ladoum sheep

Ladoum belongs to the group of *Maure* short-haired sheep whose origin is much disputed (Thior, 2013). In inventory of sheep breeds in francophone Africa (Planchenault and Boutonnet, 1997) [17], Ladoum sheep is not espectiv while Touabire sheep is included. However, results obtained with regard to morphobiometric parameters of Ladoum sheep (Sall, 2007) [20] seem to indicate a racial difference with the Touabire described by Kane (1995) in Mauritania. Ladoum sheep is characterized by a good bone structure, a large pelvis and a convex chamfer. Females often have horns and strong udders (Thior, 2013). Animals of this breed are hypermetric and slender. If we consider adulthood from 19 months and based on morphometric measurements linked to production such as live weight, height at withers and body length, we can classify Ladoum as large format sheep.

Indeed, the mean of these measurements of adult males are: 100,5 ± 5,5 kg, 105,75 ± 2,21 cm and 102 ± 0,81 cm respectively for live weight, height at withers and body length (Sall, 2007) [20]. Regarding females,), height at withers 96, 07 ± 1,73 cm and body length 94,5 ± 2,44 cm. Sexual dimorphism is very marked in Ladoum sheep. Note also the presence of horns in females (62, 93%) as described by Sall (2007) [20].

Fig 1: Ladoum ewe

Fig 2: Ladoum ram

Data collection

According to Lhoste *et al.* (1993) [13], a farming system is "*a set of technics and practices implented by a community to exploit, in a given space, plant resources by animals, under conditions compatible with the environmental constraints.*"

Method used combined observation of animal and farming practices by formal surveys with a questionnaire administered to farmers. Surveys concerned 49 breeders of Ladoum sheep breed. In absence of sampling, choice of breeders is left to discretion of interviewers who are breeding technicians used to work with them. These technicians have been previously trained to conduct characterization surveys of farming systems.

Parameters studied

The questionnaire focused on the ethnicity of breeder, his socio-professional category and acquisition mode of animals' herd. Size and structure of herds were also studied as well as determination and priorization of role and constraints of Ladoum sheep farming.

Statistical analyzes

Data entry and analysis were performed with Microsoft

Excel spreadsheet. These analyses concerned descriptive statistics (means and standard deviation for quantitative variables and, proportions for qualitative variables). Results of analysis have been illustrated in the form of tables and graphs (frequency histogram, pie charts, etc.)

3. Results

In the study areas, results indicate that Ladoum breed is mainly bred by *Wolof* at 59.19% followed by *Sérères* (18.37%) and *Alpoulars* (*Peuls* and *Toucouleurs*) who own 12.24% of surveyed herds. The *Bambara* hold 4.08% of herds and other ethnic groups (*Lébou*, *Maure* and *Diola*) are poorly represented with 2.04% each of sample (Figure 3).

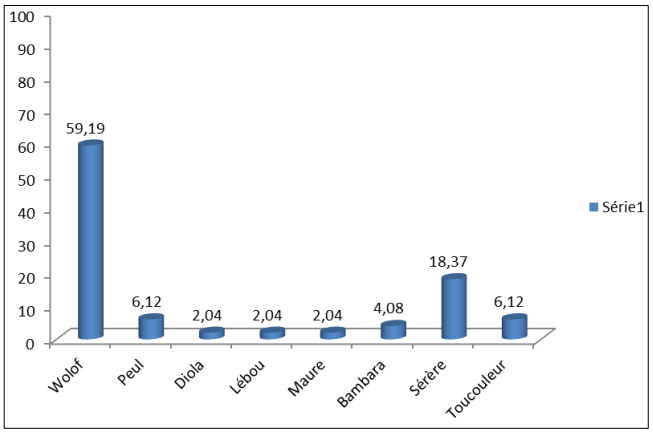


Fig 3: Ethnic distribution of Ladoum breeders on surveyed herds (n=49)

Ladoums do not have livestock rearing as their main activity. Other activities dominate breeding with 57.15% of breeders who reported activities other than breeding in the first rank. Only 42.85% of breeders have placed this activity as main. Ladoum breeding is globally considered as a secondary activity with 52.08% of the ranking in second place. For some breeders, Ladoum breeding is considered a tertiary activity (Figure 4).

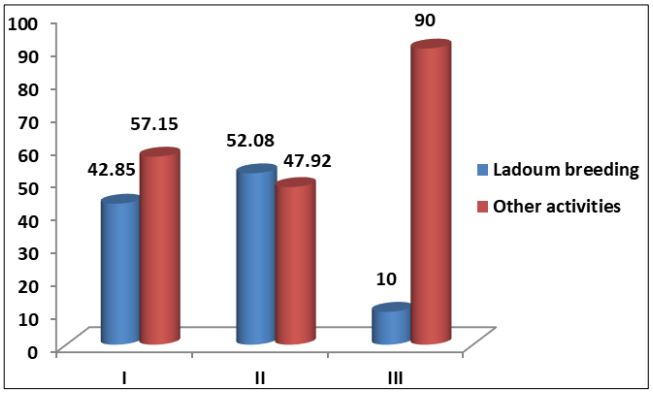


Fig 4: Distribution of Ladoum breeders in surveyed herds according to their professional activities (n = 49)

Herd size and structure

Ladoum sheep herds size shows great variability. It varies from 3 to 64 heads with an average of 16.02 individuals and a coefficient of variation of 74.3%. Most of these surveyed herds has more than 10 heads.

Animal ownership in surveyed herds

Among 49 Ladoum sheep herds surveyed, 94% belong to a single individual (individual flock). Only 3 herds (6%) are collective (animals belong to several people).

Herd size and structure

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Table 1: Ladoum sheep herd size (n=49)

Herds	N	Minimum	Mean	Standard deviation	Maximum
	49	03	16.02	11.91	64

Herds studied are characterized by ewes predominance (38,33%) followed by rams who represent 14.21% of the sample. Other categories are represented up to 13.95; 13.16; 10.7 and 9.65% respectively for female antennae female lambs, male antennae and male lambs (Figure 6).

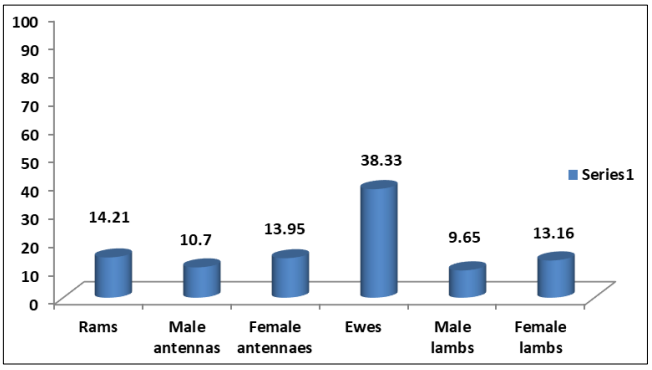

Fig 6: Ladoum sheep herd structure (n = 49)

Roles of Ladoum sheep farming

Primary function of Ladoun sheep farming is passion (PA), which recorded 54% of the statements in the first row. Income generation (GR) comes first with 21% of votes in rank II but also with 34% of breeders having placed it in the first rank. This position places it as the second function of the breeding of Ladoum sheep. Third place is occupied by savings (EP) with 37.5% of the vote. Third place is occupied by savings (EP) with 37.5% of the channels. Fourth and fifth place of Ladoum sheep farming functions are occupied by self-consumption (AC) (40%) of the opinions of breeders and the social role (RS) which represents (60%) of the votes of breeders (Table 2). Manure production (FP) and other roles of this farm which are not found in the questionnaire and which are grouped under the designation other roles (AT) have not been classified.

Table 2: Classification of Ladoum breed farming roles in surveyed herds (n = 49)

	RANKING				
ROLES	**I**	**II**	**III**	**IV**	**V**
Income generation (GR)	34	21.27	15	6.66	20
Saving (EP)	4	36	37.5	13.33	0
Self-consumption (AC)	2	6.38	12.5	40	0
Passion (PA)	54	19	20	13.33	0
Manure production (FP)	0	0	2.5	0	20
Social role (RS)	6	17.02	12.5	26.66	60
Others (AT)	0	0	0	0	0

Ladoum sheep farming constraints

Feeding is the first constraint in raising Ladoum sheep in surveyed areas. It is ranked by 38.29% of breeders as their first constraint. It is followed by animal health, which is cited 31.9% 31.9% by breeders in first place and 21.95% at rank II. Third and fourth place are occupied by cattle theft and selling (Table 3).

Table 3: Classification of Ladoum sheep breeding constraints in surveyed herds (n = 49).

	RANKING			
CONSTRAINTS	I	II	III	IV
Health	31.9	21.95	24.13	57.14
Food	38.29	41.46	17.24	0
Watering	0	2.43	6.89	0
Sale	6.38	12.19	27.58	0
Cattle theft	14.89	9.75	20.68	14.28
Habitat	8.51	12.19	3.44	28.57
Others	0	0	0	0

4. Discussion

Known in Senegal at the beginning of the 2000s, Ladoum sheep breed is mainly raised by *Wolof* in surveyed areas (59.18%). This can be explained by the fact that this ethnic group is predominant in Senegalese cities which the study was carried out.

Peul ethnic, who have a tradition of breeder only come in third position in Ladoum breeding which can be explained by their low representation in the study's areas (Dakar, Thiès, Mbacké), but also by difference in type of breed with that other breeds usually raised by *Peul*.

Indeed the breeding of the Ladoum breed is intensive with a strong investment in food, health and habitat. Other ethnic groups (*Diola*, *Lébou*, *Maure*, *Bambara*) are also poorly represented in farming of this breed. Even if they are fairly well represented in part of the study's area (Dakar region), *Lébou* do not have a breeder tradition.

Our results are in agreement with those reported by Fall (2016) [7] who estimates that 65% of sheep farmers are Wolofs in Thiès commune. This small difference in values may be due to the fact that he was interested in the breeding of all sheep breeds in Thiès while our work is only focused on Ladoum breed and, in addition, takes into account other regions (Mbacké and Dakar).

This strong membership of the Ladoum race by (the) Wolofs is due to the fact that they are in the majority in the big cities, predilection zone of breeding of this sheep. This race has established itself as a valuable race and is thus the (property) possession of a certain elite with fairly substantial financial means and seduced by Ladoum and its breeding, the possibility of saving and also of doing business).The strong membership of Ladoum breed to Wolof is due to the fact that they are mainly found in great cities, predilection area for this sheep breeding. Ladoum sheep has established itself as a valuable breed and is therefore property of a certain elite with fairly substantial financial means, seduced by Ladoum and its breeding, with the possibility of saving and also making business. One of characteristics of this breed is its ability to attract neo-breeders (traders, state agents, businessmen, etc.) to animal production sector.

According to Ba (2004), sheep farming in Dakar is a social phenomenon which has great importance, with almost one house in two practicing it. All family members (men, women, children) are involved in animal care.

Ladoum sheep breeders have other activities that differ from farming. Among these breeders, breeding is a secondary activity ranked with 52.08%. Other activities of these breeders exceed breeding in the ranking of the main activities of latter with 57.14% in the first rank.

Actors who are in Ladoum breed farming are traders, teachers, civil servants, workers etc. These farmers do not generally depend on farming activity for their daily needs. Some of them consider this activity as a passion rather than a means of subsistence.

Average size of sheep herds is 16 heads per farm with great variability (CV = 74%). Most herds (65.3%) have more than 10 head of animals. The modest numbers observed, compared to those noted in extensive herds in rural areas, are compatible with an intensive farming system where the main constraints are habitat, food and health.

In Ladoum sheep herds, presence of more than one ram per 4 ewes is characteristic of intensive production systems. Rams' number in herds can be the result either of a greater commercialization of females, or of a voluntary retention of males due to the role of prestige played in this breeding, or of a difficulty of breeders to sell these animals or to use them for self-consumption. Indeed, due to high market value of these animals they become difficult to access for most of population. This same value almost prohibits sacrifice of the animals for self-consumption. These animals thus become difficult to mobilize savings.

Another no less important factor to consider is peculiarity of this breeding which incomes are not only generated by end products such as sale of live animals or meat, but more by reproduction (paid breeding) which provides significant incomes to owners. It is rather and above all genetics that is marketed even through males or females' sale.

Antennae and lambs are important as well as by their numbers and their functions. Indeed, they represent "future" of herds and thus benefit special attention from breeders. Animals in these categories are also most often sold and allow breeders to profit from the activity.

Ewes are dominant in the herds which show that the breeders give an important place to multiplication of their flocks.

Our results show that Ladoum sheep farming has passion as its main role with 54% of the rankings in first place. Note however that 34% of breeders rank income generation as main function of this activity and in first place in the ranking.

Our results corroborate those of Thior (2013) who estimate that in Thiès region the first motivation for raising Ladoum sheep is passion and love for 52.70% of breeders.

However, they differ from those of Fall (2016) [7] who reports that in the commune of Thiès, real motivations for raising Ladoum sheep are primarily economic at 78.57% and sentimental at 13.1%.They also differ from those of Ousseini (2011) [15] who reports in the same area that passion and pleasure (25.7%) are the main motivations of breeders for raising this breed.

If passion is the main function of this activity as shown by our results and those of Thior (2013), it could mean that Ladoum sheep breeders do not care too much about profitability. This also means that passion for having them is enough as a reason to pratice their breeding as is breeding of certain pets. Note however that a good part of Ladoum sheep breeders who highlight passion, are very interested by investment returns. They generally start the activity for

pleasure, but realize the investments made on a daily basis (food, care and maintenance), which quickly become heavy, justifying a need for profitability.

To develop Ladoum breeding, breeders should be made aware of need to change their paradigm by making production as the main objective of this activity.

Note that majority of Ladoum breeders make a good living. They are mainly large traders, business leaders, civil servants, businessmen etc. (Thior, 2013; Ousseini, 2011) [15]. The merit of Ladoum sheep breed is to attract these socio-professional categories to the livestock sector.

Second function of this activity is income generation. This shows that even if breeders declare passion as the main motivation for Ladoum breeding, those who practice it care about its economic functions. Self-consumption occupies a marginal place in priority order of Ladoum sheep breeders. This is explained by market value of animals which means that their slaughter cannot be justified only by satisfaction of needs for self-consumption of households or during family and religious ceremonies.

Food constraints are the primary difficulties of Ladoum sheep farmers. They are due to the high cost of food especially those from food industry (concentrates), which are commonly used in Ladoum sheep breeding. Because type of breeding is intensive, food expenses are daily and therefore become very burdensome for breeders. Feeds distributed to animals are very variable and consist of peanut tops, cereals (sorghum, maize, cowpeas, etc.), industrial foods (concentrates, cottonseed, molasses, etc.) and leftover food. Mineral supplementation with lick stones is almost widespread and permanent in most of surveyed herds. These results confirm those of Thior (2013) and Ousseini (2011) [15] in Thiès city of and those of Goudiaby (2013) [9] in Kaolack city.

The second constraint is that linked to health. Indeed, breeders have highlighted parasitic infections, abortions and neonatal malformations as main diseases in this breed. It should however be noted that these breeders live in town with proximity of private veterinarians and therefore should have easy access to good health monitoring of their herd. But the costs of veterinary interventions remain prohibitive.

The third constraint is sale of live animals. Indeed, given their high market value, these animals are difficult to access for a majority of population and therefore difficult to sell for breeders.

Due to requirements of Ladoum sheep breeding, habitat of these animals is also reported as a constraint. They are generally parked in sheep-folds built with cement and the wall facades often tiled to facilitate cleaning.

5. Conclusion

Sheep farming is very important in West African countries including Senegal. The interest accorded to Ladoum breed is justified by its socio-economic importance. It is a secondary activity for most of those who practice it. Indeed, Ladoum sheep breeders are above all traders, civil servants, businessmen, etc. that this breed attracts in animal production sector because of their value, aesthetic beauty and their adaptation to farming system in town. This breed is mainly bred by Wolofs but all Senegalese ethnic groups are found in this activity. Ladoum sheep breeding has several functions (income generation, passion, self-consumption etc.) and is confronted with several constraints (food, health, sales etc.). Given the enthusiasm for this breeding and its development in cities, the public authorities should pay more attention to it. Thus, from this breeding, establishment of a national sheep self-sufficiency program could be developed. With rigorous scientific supervision, this breed could serve as a basis for improving size of our farm animals, and significantly contribute to increase sheep production (meat, milk, etc.) through crossbreeding.

6. Acknowledgements

The authors sincerely thank "Programme de Productivité Agricole en Afrique de l'Ouest" (WAAP / PPAO) which funded this study. Their acknowledgments are adressed to Dr Ndiaga Cissé, Director of Centre d'Études Régional pour l'Amélioration de l'Adaptation à la Sécheresse (CERAAS) (), for supporting grant application. They also thank technicians who ensured data collection and breeders who agreed to participate in this study.

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