



# **Goat Farming in the Arganeraie of Agadir in Morocco: Livestock System and Production Parameters**

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## **Authors' contributions**

*This work was carried out in collaboration between both authors. Author EMS designed and supervised the study, carried out the statistical analysis, wrote the first draft of the manuscript and followed the steps of the article review. Author EKH carried out the survey and the monitoring of the animals in the field, wrote the protocol and managed the analyzes of the study. Both authors have read and approved the final manuscript.*

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## **ABSTRACT**

In order to characterize goat farming of the arganeraie in the province of Agadir in Morocco. A structured questionnaire survey and individual monitoring of farm animals were conducted in 35 randomly selected goat farmers in 9 villages of Amskroud commune in Agadir province. The results obtained show that the livestock system is extensive, traditional and oriented exclusively for the production of meat. The goat herd is heterogeneous and composed mainly of local breeds, with the dominance of the Atlas (Black) and Barcha breeds which represent approximately 80% of all goats. The prolificacy rate is 108.25%, the true fertility rate is 78.24%, while the apparent fertility is 69.83%. The mode of reproduction is free without the control of farmers and consanguinity is widespread. For 45.72% of farmers, the age at first kidding is approximately 12 months, while for

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37.14% it is less than 12 months and for 8.57% it is between 14 and 24 months. The kidding are spread throughout the year and the number of calving per goat per year is 1 for 71.43% of farmers, while it is 1.5 for 28.57%. The interval between successive kidding is very variable. For 34.29% of farmers the kidding interval is greater than 12 months, 31.43% have an interval less than 8 months and 28.57% have an interval between 8 months and 12 months. Abortions are found among the 65.71% of farmers surveyed with an abortion rate of 28.42%. The overall mortality rate is high with a youth mortality rate <1year is 3.4% and that of youth> 1year is 9.36%. There is a virtual absence of food supplementation, health care and adequate infrastructure. Goat farming in the region faces several constraints (socio-economic, food, health, environmental and livestock management) that reduce its productivity and limit its development.

*Keywords: Livestock system; local breeds; goats; Arganeraie; Morocco.*

## 1. INTRODUCTION

Goat herds account for just over 1 billion goats worldwide, of which about 420 million head (40.9%) are raised in Africa. Morocco's goat herd currently accounts for 5.23 million head [1] is composed mainly of hardy local breeds which are characterized by a good adaptation to local climatic conditions and it is mostly concentrated in difficult and mountainous areas [2]. Goat farming is a key sector of agriculture and its versatile function, is of socio-economic importance and plays a dynamic role in the development of economic activity in rural areas. Goats with Arganeraie as their farming zone account for 16% of the goat herd nationally, followed by cattle and sheep which account for about 6% of their species [3]. In Amskrout commune in the province of Agadir, livestock numbers vary from one year to the next, depending on the climatic conditions, which represent more than 75% of the livestock in the commune [4]. Goat farming on the Arganeraie depend in part on food from argan forests, the diet is based on a well-identified vegetation dominated by argan products that characterizes the meat of the kid. Goat meat is a biological product and is a source of animal protein but also income for rural populations, especially in developing countries [5,6]. Thus, this also contributes to the supply of handicrafts and industry in raw materials (skins, leather and hair) [7]. The aim of this study is to characterize the goat farming system of the Amskrout argan forest in the province of Agadir in the Souss Massa region.

## 2. MATERIALS AND METHODS

The study was conducted in Amskrout commune in the province of Agadir (Fig. 1) with 35 Goat farms randomly selected in 9 villages (Fig. 1)

with a total of 598 goats that were monitored. The fieldwork started with an individual survey of farmers to treat the various links in the argan goat industry. The study area has an average atmospheric temperature of 17°C with 38% Humidity. This survey is a contribution to the knowledge of the goat farming situation of Arganeraie in this region. Arganeraie Biosphere Reserve, Morocco designated by UNESCO in 1988: Located in the southwest of Morocco, this biosphere reserve covers a vast intramontane plain of more than 2,560,000 hectares, bordered by the High Atlas and Anti-Atlas Mountains and open to the Atlantic in the west. The area is known for its endemic species, the Argan (*Argania spinose*), which is not only important in terms of conservation, but also for research and socio-economic development. The Argan oil has multiple uses in cooking, medicines and cosmetics. The trees are also used as fuelwood for cooking and heating (UNESCO).

Socio-economic data on goat farmers are related to age, sex, family size, level of education, main occupation, livestock experience and nature of the labor force, work, etc. were taken. The zootechnical data are related to herd composition, herd management, feeding, health and reproductive parameters.

## 3. RESULTS AND DISCUSSION

Goat farming has emerged in this study as an essentially male activity, with an age ranging from 27 to 77 years. The level of education is generally very low, with 74.29% of the farmers being illiterate. The goats of all the farms surveyed are conducted in an extensive system. The study of the distribution of species exploited within the farms shows that 62.86% of the herds include sheep and goats. The breeding system is of extensive type. The goat herd is





Fig. 3. Photos of the main local goat breeds

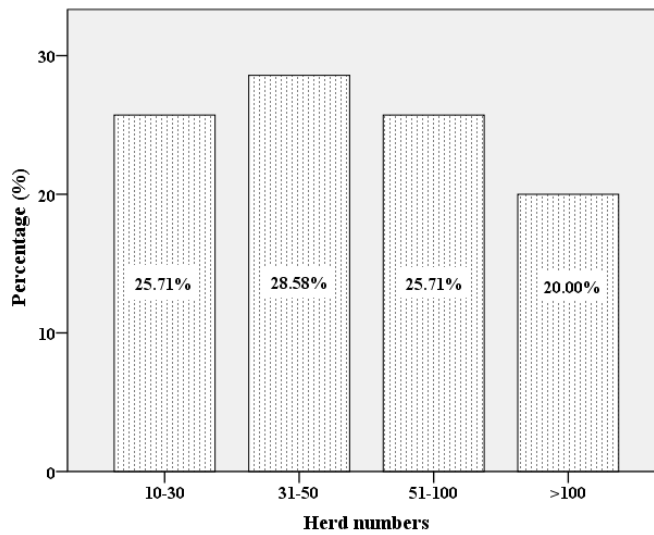


Fig. 4. Variation in the herd size

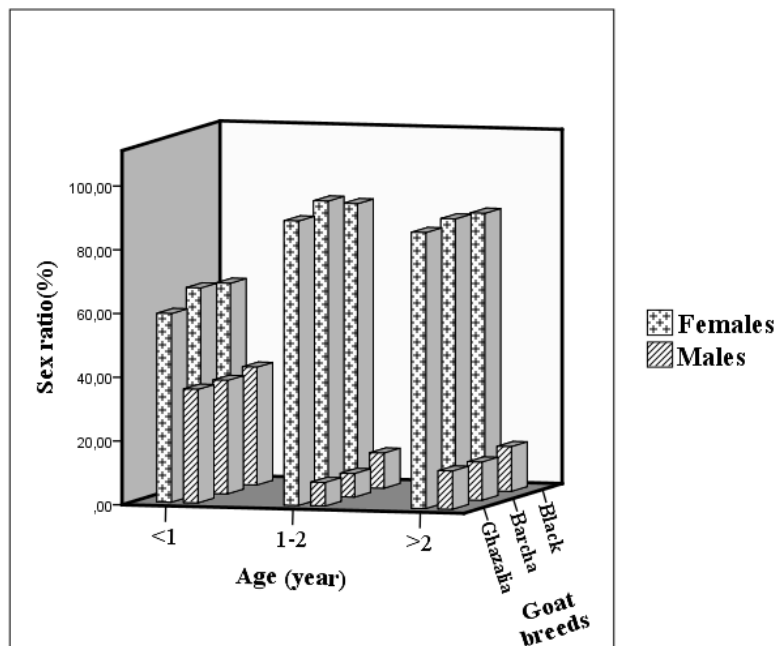


Fig. 5. Sex ratio by age of the three main goat breeds

Goat farming is extensive, and its diet is based on silvopastoral resources (forest resources), either through direct grazing or lopping, all year round, except for the duration of the grazing period. of "Agdal" for the argan tree, between July and September. During this period the animals exploit the areas occupied by *Juniperus phoenicea* [Arar] and other fodder shrubs. During the winter, the animals graze on the neighboring paths. The argan tree is a predominant pastoral resource, the goats take in both pulp and leaves, on the ground, or during aerial grazing. The history of the goat in the argan tree is part of a long process of continuous presence in the family activities of the local populations of South-West Morocco and the goat is the only species able to take advantage of the agro pastoral resources of the argan tree [9]. The organization of pastoral practices and the way of conducting livestock remains dependent on the fodder supply of the argan tree which, according to Naggar and Mhirit [10], "the argan tree contributes more than 37% to the forage balance" but the economic evolution of the argan oil industry raises uncertainties about the future of livestock farming in the area and the ecological balance of argan plantations [11]. No sanitary conduct is practiced by the breeder in general. Vaccination of animals is not assured for 25.71% of farms and 74.29% do not have access to health care. Health problems such as diarrhea and weight loss caused by internal and external parasites are very common and cause many losses. Gastrointestinal infections and pulmonary nematodes therefore appear to be one of the main causes of indirect mortality in goats and insufficient reproductive performance of goats in the semi-arid Middle Atlas region of Morocco [12]. In the study area, for 37.14% of breeders the age at first calving is less than 12 month, it is equal to 12 month for 45.72%, while for 8.57% of farmers it is between 14 and 24 months (Table 1). The age at first calving is a reproduction parameter that provides information on the

earliness of young females at entry into production. It varies greatly depending on the breed and the way of conducting goat farming. Environmental constraints also play a role, sheep and goats in wet and subhumid areas are often earlier reproduction than those in semi-arid and arid areas [13]. The value in certain regions, notably the High Atlas, is less than 2 years [14]. In the Draa goat, it is 5 to 12 months old [15]. According to the Northern Goat studies, this parameter varies from 12 months [16] to 18 months [17]. In Algeria, it is 12 to 18 months old [18].

Kidding recorded in the study area show that 77.14% of goats have single births, while 22.86% of births are double, which translates into low reproductive performance. The number of kids per goat per year is 1 for 71.43% of farmers, while it is 1.5 for 28.57%. The kidding interval is greater than 12 months for 34.29% of farmers, 31.43% have an interval of less than 8 months and 28.57% have an interval between 8 months and 12 months (Table 2). Other values of the interval between kidding are noted in the High and Anti-Atlas, respectively 8-12 months and 10 months [14]. For the Draa goat, an average interval of 9 months with a variation of 6 to 12 months has been reported [15]. The kidding interval is very variable and they are distributed throughout the year, because the males are permanently found with female goats. For goats with a kid once a year, calving take place in October-November and March-April. Calving concentration is observed in February-March. Those who give twice a year, calving takes place from October to November and from June to July. For the black goat, kidding are spread all year round, especially from December to April (Boujenane, 2005). Other authors have shown two periods of kidding of the local population, November-April and July [19], September-October and March [20] and December-March and May-June [21].

**Table 1. Age at first kidding**

<b>Age at first kidding</b>	<b>Percentage (%)</b>
Less than 12 months	37.14
Equal to 12 months	45.72
between 14-24 months	8.57

**Table 2. Kidding interval**

<b>Kidding interval</b>	<b>Percentage (%)</b>
Less than 8 months	31.43
Between 8-12 months	28.57
Greater than 12 months	34.29
Unknown	5.71

**Table 3. The reproductive performance of the livestock of the municipality Amskrout**

<b>Reproductive parameters</b>	<b>(%)</b>
Prolificacy rate	108.25
True fertility rate	78.24
Apparent fertility rate	69.83
Fertility rate	75.59
Abortion rate	28.42
Mortality rate kids <1 year	3.4
Mortality rate kids > 1 year	9.36
Mortality rate females > 2 years	15.17
Mortality rate males > 2 years	2.75

The prolificacy rate of the local population is 108.25% (Table 3), this rate is mainly influenced by several factors including food. The prolificity results obtained in local breeds in other regions of Morocco are almost similar and vary from 100 to 110% [15]. The true fertility rate of the local population in the study area is low at 78.24%, while the apparent fertility is 69.83% (Table 3). This rate is similar to that found by Anjar et al., [22] in East Morocco (78%) and that reported by Lafdaili M. [23] in the Dakhla region (79%). On the other hand, it is higher than that obtained by Amanoune [24] in the Eastern highlands 74% and low compared to those reported by [25] in northern Morocco and in Andalusia respectively 93.1 % and 89.0%. The observed fertility rate is very low at 75.6%. Abortions are found among the 65.71% of breeders surveyed with an abortion rate of 28.42% (Table 3). Abortions occur at different stages. Among the causes of abortion and a nutritional imbalance, accidents at the level of the herd.

The overall mortality rate is very high (30.7%), in goats > 2 years and in kids and goats > 1 year is equal to 15.17% and 9.36% respectively (Table 3). High mortality is observed in October for the majority of farms. The causes of this mortality are multiple, in most cases result from an unsuitable diet limiting the food intake to the kids. Dietary insufficiency causes a decrease in milk production, hence a decrease in the growth and viability of kids who are less resistant to disease, the other cause of mortality invoked is the cold especially for kids and goats. The evaluation of the performance of extensive goat farms in the north has shown variable estimates of the average mortality rate of young people equal to 16.2% [26] and 27.12% [25]. According to a study carried out among 70 goat farmers in the rural town of Aït Bazza in the Middle Atlas, a mortality rate of 25.30% has been reported, which can vary according to the breeders from 5 to 90% [27]. In the Ouarzazate area, declared

goat losses are estimated at 16% and can sometimes reach more than 30% [15]. In Morocco, the overall mortality rate is very high (over 35%) compared to the Andalusian livestock system (7%) or the French livestock system (4%) [28]. This is due in particular to the conditions of management and hygiene, the quality of the buildings and the non-use of veterinary services. Other authors [17,29,30,31] reported rates ranging from 19 to 41% in northern Morocco and Algeria [32,18]. These high mortality rates are generally due to unsuitable farming conditions and low use of veterinary care.

#### 4. CONCLUSION

The evaluation of farming conditions has shown that the livestock system is traditional extensive type where the herds are conducted on the rangelands with a diet based on the exploitation of sylvo-pastoral resources. The overall mortality rate is high, the average size of herds is variable but mostly represented by small numbers and the management of reproduction is almost nil. The reproductive performance of goat herds is relatively low and remains below standards. It can thus be seen that goat farming in Amskrout commune in the province of Agadir is not very productive because it faces several constraints. Better control of the technical management of farms, better monitoring of health problems and a good selection of successful broodstocks are necessary to have better productivity.

#### COMPETING INTERESTS

Authors have declared that no competing interests exist.

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