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# Goat breeding systems in the South of Tunisia (Tataouine)

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**Abstract.** Goat population in Tunisia is around 1.5 million concentrated in the arid regions, mainly in the South. The local genotype (Arbi) is the most prevalent and kid meat is the main product from this breeding. Two breeding systems were identified: pastoral and agro-pastoral systems. The averages of fertility, fecundity and prolificacy were generally low (genetic characteristic of the breed) and varied between 86-91%, 89-92% and 130-140% respectively. The lowest values were recorded for herds managed under pastoral systems. Kiddings are concentrated in autumn-winter. Goats are always associated with poor-quality lands, with difficult access. Thus mortality of kids is often greater than 12% and the abortion rate usually exceeds 10%. The common feeding systems are grazing during the day and housing at night where supplementation with concentrate feeds is provided for lactating does. Nutrient productivity of pastoral rangelands varied between 30 and 60 UF/ha/year during favourable years (rainfall around 100 mm/year) and 10-20 UF/ha/year during dry years (rainfall < 50 mm/year). The aim of this study was to describe goat breeding systems in the South of Tunisia (Tataouine) under different climatic conditions and the possibility to ameliorate their productivity without detrimental effects on the environment.

**Keywords.** Tunisia – Goat – Productivity – Breeding system – Rangeland.

## **Systèmes d'élevage caprin au sud de la Tunisie (Tataouine)**

**Résumé.** En Tunisie, l'effectif de la population caprine est aux alentours de 1,5 million concentré dans les régions arides du pays, et principalement au sud. La race locale est dominante, et la viande est sa production principale. Deux systèmes d'élevage ont été identifiés : système pastoral et agro-pastoral. La fertilité, fécondité et prolificité du troupeau sont faibles (caractéristique génétique de la race) et ont oscillé entre 86-89% (fertilité), 89-92% (fécondité) et 130-140% (prolificité). Les valeurs les plus faibles ont été observées dans les troupeaux conduits en système pastoral. Le chevretage est concentré durant la période automne-hiver. Le troupeau est toujours associé à des parcours de faible qualité nutritionnelle et à accès difficile, d'où le taux de mortalité des jeunes souvent supérieur à 12% et le taux d'avortement à 10%, respectivement. La supplémentation en concentré n'est disponible qu'en période critique de l'année et pour les femelles en lactation La valeur nutritionnelle varie de 30-60 UF/ha/an, durant les années pluvieuses (précipitation >100 mm/an) et de 10-20 UF/ha/an durant les années sèches (précipitations <50 mm/an). Les objectifs de cette présente étude sont l'identification des systèmes d'élevage caprin au sud de la Tunisie (Tataouine) et les perspectives d'amélioration de la productivité de la race sans dégrader le parcours.

**Mots-clés.** Tunisie – Chèvre – Productivité – Système d'élevage – Parcours.

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## **I – Introduction**

In Tunisia, a North African country, due to the increasing rate of rangeland degradation (mainly in the South) and economic instability at the international level, livestock feeding is facing serious difficulties related to quantitative and qualitative provision of nutrients and this is exacerbated by the continuous rise of feedstuffs' prices. Even though, national goat population has increased by 23% in the last decade (1997-2007), reaching more than 1.5 million heads. More than 60% of the population is raised in the arid area (DGPA, 2005). The growth of goat

population has been followed by significant increase in production. In 2007 annual goat milk production was 13,800 tons and goat meat production 11,300 tons (+25% and +36%, respectively, in comparison with data of 1997; FAOSTAT, 2009). The local goat breed named Arbi (which means local, to distinguish it from imported breeds) has shown a large morphological and productive variability with a particular adaptation capacity to adverse natural environmental conditions (Gaddour *et al.*, 2008). The Arbi goat is long haired and the prevailing color is pure black; it is small-sized, with an average adult body weight of 35 to 40 kg for females and 50 to 60 kg for bucks and both sexes are horned (Khaldi, 1990).

In the North of Tunisia, goats are reared in extensive mixed farming systems (Ammar *et al.*, 2008), together with sheep and cows, but almost 60% of the Tunisian goats are located in the Centre and South, reared in semi-intensive oasis systems, in small herds (Gaddour *et al.*, 2007a,b). Although these agricultural systems are changing, owing to socio-economic development, maintenance of this farming scheme is guaranteed by national projects for the development of the small ruminant sector. Indeed, genetic selection programmes and biodiversity conservation strategies are currently studied in Tunisia for the native goat (FAO, 2007). In some cases, the genetic capacities represent a serious restriction to improve goat production, especially for milk (Gaddour *et al.*, 2008). Failures in livestock improvement programs (national and international projects) did happen and animal productivity has remained poor.

Our main objective in this study was to investigate the characteristics of predominated goat breeding systems in the South of Tunisia (Tataouine), where local breed is essentially raised, and the perspectives of their productivity improvement without degradation of natural rangelands.

## **II – Material and methods**

### **1. Study area**

The study was carried out in the governorat of Tataouine located in far South in Tunisia and extended on 38,889 km<sup>2</sup> (20% of the total Tunisian area, Fig. 1). This region borders on Medenine and Kebili governorats to the North, and Libya to the East and Algeria to the West. The governorat is sub-divided into four natural regions namely: the mountainous region (the range mountains of Matmata forming a vast valley in the South); Dhafer plateau, situated to the West of the range mountains of Matmata; Oriental steppes of el Ouara and Jefara, situated to the East of the government; and the large oriental Erg, a Saharian extension. Seven village communities (Tataouine North, Tataouine sud, Ghomrassen, Remada, Dhibet, Samar and Bir Lahmar) are included in the government. The agricultural area covers 17,000 km<sup>2</sup> dominated mainly by natural rangelands (15,000 km<sup>2</sup>), which are grazed by 5.5 million heads of sheep and goats (10% of the total population) and 25,000 heads for camelides (50% of the total population). It is a Mediterranean-desert climate, which is characterized by minor annual precipitations (less than 100 mm) and high temperatures (more than 40°C).

### **2. Data collection**

General information on the majority of livestock population, including goat grazing systems, land use and vegetal resources (quantity and quality) and animal performance was collected by the Office d'Élevage et des Pâturages (OEP) at Tataouine in order to keep traceability archives, and get the most accurate data. In our study, data from eighty four flocks recorded in the OEP since 2005 for their continuous survey, mainly composed of goats, was used. It is worthy to mention that the herds before being recorded in OEP were sanitary tested to approve their good health. Where animal proved ill, have a corporal note <3 (for adult), apparently sterile, is eliminated from the flock. Once is recorded, every animal gets its identification card. Since the moment of their record on, all animals are annually vaccinated by veterinary services of local

public organisms (Comité Régionale de Développement Agricole and OEP). Annually non productive animals are eliminated from the flock and replaced by youngs issued from the selection (on the basis of parent's characteristics). The rate of replacement is determined by the service and according to the objective of the breeder (in favourite years the tendency is to increase if not animals are sold at very young age).

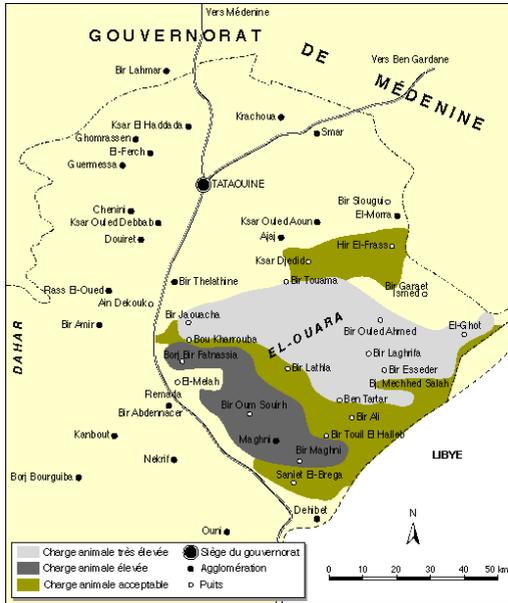


Fig. 1. Geographic situation of the study area.

### III- Results and discussion

Traditionally, livestock production systems developed in the South of Tunisia were based on the use of large rangelands and the transhumance to Central regions and even neighbouring countries (Algeria, Libya). However, in the course of the last decades they have undergone deep changes, such as the disappearance of traditional rules of rangeland management and transhumance in particular. Animals in our study were fed either on mountain rangelands nearby "Jessour" and/or on rangelands of Dhahar. Transhumance duration on grasslands of Dahar depends on climatic conditions and plant vegetative growth. Therefore, it can be assumed that two different range management options are prevalent: the "private" and "the collective non-improved". Related to these management options, currently two livestock production systems prevail: pastoral and agro-pastoral. Moreover, Arbi genotype is often considered able to reproduce all the year long, as well as other rustic goat breeds (Gaddour *et al.*, 2007a). Based on this classification, twenty nine out of the eighty four herds were included in the agro-pastoral system, the remaining herds (fifty five) were considered within the so-called pastoral system.

Grasslands are characterized by a wide variety of steppe-like vegetation : *Rhanterium suaveolens*, *Aristida pungens*, *Arthrophytum scoparium*, *Lygeum spartum*, *Stipa lagascae*, *Retama raetam*, etc. The predominant species is *R. raetam* (19%) and the least abundant species is *A. scoparium* (1%). In wet years (precipitations >150 mm) animals are maintained on pastures as long as possible. The feed energy production varies between 30 UF/ha/year (*A. scoparium*) and 60 UF/ha/year (*R. raetam*). However, during dry years (precipitations <100 mm) energetic value of the pasture decreases drastically (67%) and animals spend long times

grazing on browse-lands (Ghaba) and need to be supplemented with concentrate and barley during 3-12 months, depending on the rainfall. Therefore, the low fodder potential of the area of study coupled with the degradation of natural rangelands resulted in excessive use of supplementary feeding for an extensive system, which may have an important impact (either positive or negative) on the rangelands. The widespread utilization of subsidized feed supplements results in an increase of stocking rates which are far beyond the carrying capacity, thus aggravating range degradation.

Irrespective of breeding system, meat (kid or chevon) is the main production but also milk is produced for home consumption.

## **1. Characteristics of current livestock production systems**

### ***A. Pastoral system***

In the Tunisian arid regions, since centuries, the most traditional pastoral breeding system allows to valorize the rangeland resources by nomad small ruminant herds under harsh conditions. This is the case, in the present study, of herds farmed in the desert hills, grazing rangelands of Douz, Kebili and north-eastern Dhahar. In the remaining herds, goats are grazing on the grassland of El Ouara and Dahar (centre and South) and nearby villages (Ghoucha and Sidi Makhlof). For the collective rangelands, the large open lands require the presence of specialized shepherds, aware of the resources distribution in time and in space.

Transhumance is the most common practice in Dhahar sites, in order to reduce the feed costs and to cope with water shortage. When transhumance cannot be carried out, other techniques are followed, such as efficient use of water ponds, cisterns, and small dikes. The other option is to use tanks to transport water to livestock settlements. Under unfavorable climate conditions, especially drought, the main strategy of farmers is to reduce the herd size. Thus, in spite of the presence of collective or private rangelands livestock flock size varies greatly. The average flocks size ranges from 165 (desert hills) to 218 heads (Dahar and El Ouara) composed of more than 50% of goats. Large size flocks of more than 600 heads, rather frequent in the past, have become rare but are still present in the large steppe-like rangelands of our area of study.

### ***B. Agro-pastoral system***

In this management system, herds are essentially situated in hills, mountain areas and peri-urban zones near to villages. It is traditionally based on grazing with or without field fertilization and on short-term fodder crops. Intensive fodder crops are usually based on a rotation between short-cycle crops directly grazed in winter, and spring cereal crops. Flock size ranges between 25 and 393 heads with 25 to 100% goats. In the agro-pastoral system, the proportion of families that have an off-farm income is high and may reach 66%. Rangelands are of smaller size and agricultural activity based on cereal (barley) and tree planting process (olive and fig) is integrated with livestock. The trend is toward the reduction of flocks' size and to a greater integration of livestock and crops. It is worth to indicate that tree planting was used as a way of land appropriation. This process generated a serious conflict between croppers and breeders. Shepherds almost disappeared and are used only for the rare transhumance of flocks. For this purpose, flocks in Dahar or El-Ouara are usually subject to an association agreement or "Khlata" and grouped with one shepherd. The herds are of medium size and a large proportion of farmers own less than 60 heads composed mainly (57%) of goats. According to the importance of the flock size, its composition, and importance of the family labor, farmers use several alternative systems of shepherding, such as guardianship by a family member or recruitment of a shepherd. It is pertinent to mention that the association agreement is beneficial, firstly because goats from small male-lacking herds can be mated; secondly for getting free access to collective rangelands. However, the continuous access to these collective rangeland areas coupled with the increasing livestock numbers implies that rangelands natural resources are subjected to a gradually severe degradation process (Ammar *et al.*, 2008). Although tree

planting, particularly olives, reduces the grazing area, it also prevents rangeland degradation. On the other hand, by-products such as olive cake, fine stems and dried leaves constitute a supplementary feed resource, which can be prolonged for six months. Therefore, herds are partially independent of the rangelands. Moreover, for a better management of collective rangelands, organization of ethnic groups in Tataouine, a priori a tangible solution, has successfully occurred (Ben Salem, 2010). In this approach local communities were represented by agriculture development groups which are in charge of collective rangeland management and other activities.

**Table 1. Characteristics of reproductive performance (average on five years) of the herds under pastoral and agro-pastoral systems**

Parameters	Age at 1 <sup>st</sup> mating (months)	Mating duration (months)	Age of kids at selling (months)	Reproduction age of male (years)	Reproduction age of female (years)	
Pastoral	17	3	5	9	9	
Agro-pastoral	11	3	4	9	9	
Parameters	Young kids (%)	Fertility (%)	Fecundity (%)	Prolificacy (%)	Abortion (%)	Kid's mortality (%)
Pastoral	23	86	89	131	5	9
Agro-pastoral	32	91	92	140	8	6

Although the native goat breed from Tunisia is well adapted to its natural environment, the natural and technical resources scarcity can be considered as a factor constraining goat productivity (Gaddour *et al.*, 2008). Our results on reproductive performance (Table 1) confirmed the low productivity of the local breed particularly in pastoral systems. It is worthy to indicate that mating of herds, studied herein, generally occurs from June to October and kiddings are concentrated in autumn-winter. Therefore, the most high nutritional requirements of the herds occurred during dry season and are coincided with a poor quality roughage. On the other hand, some preliminary options for management of reproduction (flushing, steaming, male effect) and survive of kids (creep-feeding) are not commonly used due to the continuous increase of concentrate price. This can explain partly the low fertility and high abortion (>5%) and kids mortality (>6%) observed in many studied cases (Table 1). Under harsh climatic conditions and severe economic budget, decrease of herds population is the most practiced strategy followed by breeders. This fact explain largely the procedure of selling kids at young age (4-5 months). This would affect the parameter sexe-ratio (Table 1) which remain low in many cases. Coupled with precocity of male and female at first mating (<10 months), the sexe-ratio parameter would decrease fertility and fecundity. It appears, therefore, that besides health, poor producing ability of livestock usually can be attributed to critical nutrition and management constraints.

## IV – Conclusion

In our area of study, Tataouine, management under extensive systems is often characterized by a serious imbalance between the period of maximum productivity (reproduction and production) and the period of greater fodder supply. This fact, associated with a low genetic potential of the breed, would decrease productivity of the flock. With respect to land management, this implies an impaired balance between vegetal production and animal nutrient requirements. Under such conditions, goats are critical to the development of sustainable and environmentally sound production systems. Efforts should be intensified to improve productive and reproductive performances of these animals using simple and cost-effective options. Land degradation and drought justify the needs for a serious reflection on the establishment of new feeding strategies

targeting the improvement of animal production and moving towards resource conservation and natural resource management

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