Updated knowledge on breeding and feeding systems of sheep raised in Beni Mathar steppe of eastern Morocco

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Abstract

The breeding of small ruminants is the main means of livelihood and job provider for the population of the Eastern region in Morocco, with increasingly frequent use of concentrated feed without abandoning grazing. The objective of this study is to update knowledge on breeding and feeding systems of sheep raised in Beni Mathar steppe of eastern Morocco. The study was conducted through a survey of eighty-three sheep farms in the rural area of eastern Morocco. After multidimensional analyzes based on feed management and on the form the rangeland uses, three distinct groups of breeding systems in the study area were obtained. The first system included the subsistence pastoral farms (n=53) with a feeding system based mainly on stubble grazing with an annual supplementation of 25815 FU. The second one included peasant pastoral farms (n=12) grazing mainly on natural pastures and providing an annual supplement of 72374 FU. Finally, the third system is composed of speculative pastoral farms (n=14) which also benefit from the free fodder units of the rangelands but supplemented at about 103514 FU per year. The result of this study encourages to take development measures appropriate to the specific conditions and resources of each system.

Key words: sheep breeding, feeding management, multidimensional analysis, eastern Morocco.
Actualisation des connaissances sur les systèmes d'élevage et d'alimentation des ovins élevés dans la steppe de Beni Mathar à l'Oriental du Maroc

Résumé

L'élevage de petits ruminants est le principal moyen de subsistance et pourvoyeur d'emplois pour la population de la région de l'Oriental du Maroc, avec une utilisation de plus en plus fréquente d'aliments concentrés sans abandonner le pâturage. L'objectif de cette étude est d'actualiser les connaissances sur les systèmes d'élevage et d'alimentation des ovins élevés dans la steppe de Beni Mathar à l'Oriental du Maroc. L'étude a été menée à travers une enquête auprès de quatre-vingt-trois élevages ovins de la zone rurale de l'Oriental marocain. Après des analyses multidimensionnelles basées sur la gestion de l'alimentation et sur la forme d'utilisation des parcours, trois groupes distincts de systèmes d'élevage dans la zone d'étude ont été obtenus. Le premier système présente les fermes pastorales de subsistance (n = 53) avec un système d'alimentation basé principalement sur le pâturage sur chaume avec une supplémentation annuelle de 25815 UF. La seconde regroupait des exploitations pastorales paysannes (n=12) pâturant principalement sur des pâturages naturels et apportant une supplémentation annuelle de 72374 UF. Enfin, le troisième système est composé d'exploitations pastorales spéculatives (n=14) qui bénéficient également des unités fourragères gratuites des parcours mais complétées à hauteur d'environ 103514 UF par an. Le résultat de cette étude permettra à prendre des mesures de développement adaptées aux conditions et ressources spécifiques de chaque système d'élevage.

Mots-clés : Elevage ovin, Conduite alimentaire, Analyse multidimensionnelle, Maroc Oriental.
تعتبر تربية المجترات الصغيرة الوسيلة الرئيسية لكسب العيش وتوفر فرص العمل لسكان المنطقة الشرقية في المغرب، مع الاستخدام المتكرر للأعلاف المركزة دون التخلي عن الرعي. الهدف من هذه الدراسة هو تحديث المعرفة حول نظم تربية وتغذية الأغنام التي تربى في بني مطهر شرق المغرب. أجريت الدراسة من خلال مسح ميداني لثلاثة وثمانين مزرعة أغنام في المناطق الريفية بشرق المغرب. بعد التحليلات متعددة الأبعاد القائمة على إدارة الأعلاف وعلى نمط استخدام المراعي، تم الحصول على ثلاث مجموعات متميزة من نظم التربية في منطقة الدراسة. تضمن النظام الأول مزارع الكفاف الرعوية (n = 53) مع نظام تغذية يعتمد بشكل أساسي على رعي القش مع تكميل سنوي قدره 25815 وحدة حرارية، والثاني يشمل المزارع الرعوية الفلاحية (n = 12) التي ترعى بشكل رئيسي على المراعي الطبيعية وتوفر مكمل سنوي قدره 72374 وحدة حرارية. وأخيراً، يتكون النظام الثالث من مزارع رعوية مضاربة (n = 14) والتي تستفيد أيضًا من وحدات العلف الحر للمراعي، ولكنها تكملها بنحو 103514 وحدة حرارية في السنة. تشجع نتيجة هذه الدراسة اتخاذ تدابير تطوير تكتيكية مع الظروف والموارد المحدودة لكل نظام.

الكلمات المفتاحية: تربية الأغنام، إدارة الأعلاف، التحليل متعدد الأبعاد، شرق المغرب.
Introduction

Rangelands represent a significant role in several countries, such as Morocco. They cover 82% of arid regions (Mahyou, 2016), in which pastoralism is a subsistence pattern. In these areas, breeders use a mobile herds livestock to transform vegetation into a steady flow of added value products (Kaufmann and al., 2019). In a drought situation, pastoralists mobilize their herds to new areas. Therefore, the pastoralism in these regions was marked by the mobility of herds and men, and the persistence of collective use of spaces (Bourbouze, 2006). However, socio-political, and natural aspects like the climate, anthropic activities, or social changes, have driven nomadic populations toward formerly settlement and to a conversion of their mobility mode. Despite these different challenges, the breeding system is still a multifunctional activity and a fundamental element of food security even if it is practiced in an extensive way (Bechchari et al., 2014).

In the rural eastern part of Morocco, the livestock farming system is based on a native breed named Beni Guil. The latter is known for its adaptability, in arid lands, to climatic conditions. Besides, it is known for its high resistance to local parasites and to produces a high meat quality (Belhaj et al., 2021). Although this breed is under pressure due to the existence of the white Algerian breed “Ouled Djellal”. The feed sources of Beni Guil animals come from pastoral plants, characterized nowadays by a regressive dynamic. In such context, the breeders are pushed to supplement their livestock. The supplementation could reach 40 p.100 of herds having an average size of 90 LSU. The most used feeds are barley and wheat bran followed by alfalfa, dry sugar beet which are purchased from local markets (Bechchari et al., 2014).

Facing the livestock challenges cited above and previously observed by Bechchari et al. (2014), we hypotheses that feeding management has changed which may lead to a different typology of pastoral systems.

Thus, the aim of the present study was to Updated knowledge on breeding and feeding systems of sheep raised in Beni Mathar steppe of eastern Morocco and analyze their actual typology.
Materials and methods

Study area

The study focuses on the pastoral system of the rural area of Beni Mathar located in the high plateaus of eastern Morocco. Beni Mathar is 1690 km² area, which is a part of the province of Jerada with a population of approximately 108918 inhabitants of which the rural population represents 35.67% (HCP, 2021).

![Map of Beni Mathar](image)

**Figure 1. Location of the studied pasture area (Eastern Morocco by northeast)**

Climate

The study area is characterized by a Mediterranean climate with a decreasing bioclimatic gradient from North to South, the aridity increases rapidly towards the South. This contrast influences precipitation, which reaches 201 mm on average per year in the north, while in the south, its level does not exceed 143 mm per year, with a coefficient of variation of 45% and 34% (Melhaoui et al., 2018).

The region has suffered from the adverse effects of climate change. Indeed, since the beginning of the 1980s, the average annual rainfall has decreased by 29%, the temperature has increased specially the minimum temperature during the autumn season, and the occurrence frequency of drought has increased to 7 years out of 10 (François et al., 2016). Similarly, Melhoui et al. (2018) highlighted a significant downward tendency in the rainfall regime.
Vegetation

For at least the last three decades, the study area has experienced a regressive dynamic of good pastoral sites, which induces a tendency to desertification. The invasive and less palatable species or bare land have clearly increased to the detriment of favorable pastoral facies. Degraded formations (alfa, sagebrush or with degradation indicator species such as *Noaea mucronata, Peganum harmala, L. Chenopodiaceae* steppes dominated by Salsola species, etc.) have become the most dominant vegetation in rangelands in these arid regions (Mahyou et al., 2016).

Animal production systems

Animal husbandry is the main economic activity of household keepers and dominates the source of household income which are considered as poor. In general, livestock systems are classified from extensive to semi-extensive pastoral type (Bechchari et al., 2014). They are categorized as fellow:

- Extreme variability in sheep livestock depending on climatic conditions.
- Very low livestock productivity.
- High dependence of animals on purchased feed.
- A diversity of roles attributed to animals (treasury and/or social prestige, etc.);
- Traditional management neglecting all aspects of genetic improvement.

Questionnaire design and data collection

The interviewees were the farm’s holder or the herders. The survey has treated the following points: Identification of the breeder, material and equipments, herd structure, the used of rangelands, herd management, feeding system, animal watering, reproduction, and the livestock movements.

Multidimensional analysis

A principal component analysis (PCA) is applied to sixteen quantitative variables selected beforehand based on: The coefficient of variation which must exceed 50%; the correlation between two variables must not exceed 80% to keep both; the number of different values must be greater than 6; and the frequency of 0 must not exceed 40%.

The main components or factors are summaries of quite scattered raw data, and their use avoids the need to transform or standardize variables on the same scale for subsequent analysis (Bisquerra, 1989; Visauta, 1998). Six principal components (PC) were obtained, which provide the maximum of information.
The groups of farms were grouped using hierarchical clustering analysis according to the factor scores derived from PCA. Ward’s method was used because it produced the most homogeneous groups. The dendrogram generated for each group of variables allowed the definition of various clusters.

**Results**

The ACP shows six principal components that explained 75.36% of the variance. They were interpreted using the varimax rotation of the component matrix. The table below (Table 2) shows the principal components selected based on the PCA, the variance that each explained, and the variables that had an absolute value of the correlation with the PC greater than 0.5.

The first axis explains 35.20% of the total variation and is positively correlated with the variables feeder (Mng) \((r=0.65)\), total number of ewes (Totbbs) \((r=0.73)\), total number of Ouled Djellal lamb (NAgnOJ) \((r=0.79)\), total number of goats (Nchvr) \((r=0.79)\), distance from visited rangelands before sedentarization (distSed) \((r=0.78)\) and Forage units consumed by sheep (OvUF) \((r=0.61)\) which is a result of the conversion of the feed quantity from kg to FU provided by Agabriel, (2007). This component is defined by the variable “Total number of ewes.”

The second axis explains 10.72% of the total variation and it is positively correlated to the variables utilized agricultural area (Sup) \((r=0.79)\), total number of ram (totBel) \((r=0.604)\), and with Forage units consumed by sheep (BvUF) \((r=0.78)\). It is determined by the “Utilized agricultural Area” variable.

The third axis explains 9.22% of the total variation and is positively correlated with the variables Number of people responsible of the herds (N_resp) \((r=0.82)\), the average number of sheep intended for fattening (avgEffengst) \((r=0.63)\) and the distributed quantity of barley for fattening engstorg \((r=0.54)\). It is explained by the variable “Number of herders”.

The fourth axis explains 7.48% of the total variation and is positively correlated to the Number of Beni Guil ewes (BbsBG) \((r=0.53)\) and Distant \((r=0.82)\) variables. It is determined by the distance from the water point.

The fifth axis explains 6.77% of the total variation and is positively correlated to the fertility rate variable (TxFer) \((r=0.88)\).

The sixth axis explains 5.97% of the total variation and positively correlates with the variable TxFec \((r=0.93)\) (Table 2).
Table 2. Principal components selected based on the principal component analysis, eigenvalues, the explained and accumulated variances, and squared multiple correlation coefficients of the indicators with the different PCs

<table>
<thead>
<tr>
<th></th>
<th>Eigenvalue</th>
<th>%Variance explained</th>
<th>%Variance accumulated</th>
<th>Indicators</th>
<th>correlation with the PC</th>
</tr>
</thead>
<tbody>
<tr>
<td>PC1</td>
<td>5.63</td>
<td>35.20</td>
<td>35.20</td>
<td>Mng</td>
<td>0.65</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Totbbs</td>
<td>0.73</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>NAgnOJ</td>
<td>0.79</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Nchvr</td>
<td>0.79</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>DistSed</td>
<td>0.78</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>OvUF</td>
<td>0.61</td>
</tr>
<tr>
<td>PC2</td>
<td>1.71</td>
<td>10.72</td>
<td>45.92</td>
<td>Sup</td>
<td>0.79</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>TotBel</td>
<td>0.60</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>BvUF</td>
<td>0.78</td>
</tr>
<tr>
<td>PC3</td>
<td>1.47</td>
<td>9.22</td>
<td>55.14</td>
<td>N_resp</td>
<td>0.82</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>MoyEffengst</td>
<td>0.66</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>engstorg</td>
<td>0.54</td>
</tr>
<tr>
<td>PC4</td>
<td>1.19</td>
<td>7.48</td>
<td>62.62</td>
<td>BbsBG</td>
<td>0.53</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Eloignt</td>
<td>0.82</td>
</tr>
<tr>
<td>PC5</td>
<td>1.08</td>
<td>6.77</td>
<td>69.39</td>
<td>Txfer</td>
<td>0.88</td>
</tr>
<tr>
<td>PC6</td>
<td>0.95</td>
<td>5.97</td>
<td>75.36</td>
<td>Txfec</td>
<td>0.93</td>
</tr>
</tbody>
</table>

Farms typology

The cluster analysis was performed based on the six principal components retained from the PCA and generated the relevant dendrogram (Figure 2).
The dendrogram (Figure.2) shows the sequence according to which the observations and the clusters were merged. The minimum cutting height was between 5 and 10 which forms three clusters (sheep farms 3-53, 66-69, 22-61) while only one farm remains unclassified. The characteristics distinguishing the three groups are represented in Table 2.

**Group 1 (63.86% of the farms)**

Considered as subsistence pastoral farms, they represent 63.86% of the total sample. They possess a mean utilized agricultural area of 8.2 ha (SD=12.72). their herds include 80% of *Ouled Djellal* Sheep. The mean size of sheep flocks is 64.6 LU/breeder (SD=47.6) with a minimum of 8 ewes and a maximum of 200 ewes. For the goat species, the mean size of goat's flocks is about 6 LU/breeder (SD=7.35) with a minimum of 0 and a maximum of 40 heads. A total of 84.9% of breeders do not exceed 10 LU.
In terms of mobility, sedentarization is the choice of 81.1% of breeders in this group. But the herders cross an average of 23.3 Km per day (SD=42.20) to search the feeds for their animals. In addition to the rangeland uses, animals are grazing the stubble and consume also feed supplementation to respond to their needs. The breeders purchase every year an average of 72375 FU. The composition of the total feed purchased per year is given in Table 2. They rely mostly on barley and wheat bran because of their availability on the market.

**Group 2 (14.46%)**

This group of peasant pastoral farms, they represent 14.46% of the total sample. With a 53.54 ha/breeder (SD=80.17) average of utilized agriculture area. In this group, breeders prefer the *Beni Guil* sheep husbandry. The latter present 82% of the herds compared to *Ouled Djellal* with just 18%. The mean size of the sheep flocks is 239.58 LU/ breeder (SD=109.30) with a minimum of 70 and a maximum of 500 ewes. For goats, the mean size of this animal husbandry is 13.92 (SD=9.6), with 50% of the breeders possessing more than 13 goats.

With grazing on natural rangeland, the breeders purchase annually 72374 FU (SD=36173). The feed supplementation varies between a minimum of and a maximum of 17549 FU and a maximum of 115893 FU depending on the livestock size. As described in Table 2, the highest and the lowest source of energy were, barley (51941 UF/year) and Wheat (127) respectively.

For the mobility, sedentarization is a choice of 41.7% of the breeders of this group. They explain their decision by the recurring years of drought, while the rest practice transhumance to explore new rangelands. Herders' sheep cross an average distance of 30.88 km (SD= 31.66)

**Group 3 (16.87%)**

With a vast experience in the field of animal breeding, this group represents a percentage of the 16.87% of the breeders who have made the subject of the survey. They possess a mean utilized agricultural area of 43.61ha (SD=34.44). their herds include 83% of *Ouled Djellal* Sheep, showing that this breed is more productive than *Beni Guil*. The mean size of sheep flocks is 243 LU/ breeder (SD=47.6) with a minimum of 50 ewes and a maximum of 400 ewes. Even if they are not a significant difference between the livestock size and the previous group of herders, they purchase a bigger quantity of feed supplementation without abandoning the rangeland exploitation. The highest and lowest source of energy were barley (71552 FU/year) and dry sugar beet (588 FU/year), respectively (Table 2).
In addition to this feed supplementation purchases, these breeders still searching for a free fodder unit by practicing transhumance and crossing 280 km per year. This decision has not been taken by 64.3% individuals of this group. For the goat, the mean flock size is about 4.8 LU/breeder (SD=7.35) with a minimum of 4 and a maximum of 90 heads. A total of 71.3% of flocks do not exceed 50 LU.

Table 2. Characteristics of the different classes of breeders

<table>
<thead>
<tr>
<th>Variables</th>
<th>Group 1</th>
<th>Group 2</th>
<th>Group 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of sheep breeding systems</td>
<td>53</td>
<td>14</td>
<td>12</td>
</tr>
<tr>
<td>Percentages</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Utilized agricultural Area (ha)</td>
<td>8.2 ha</td>
<td>53.54</td>
<td>43.61</td>
</tr>
<tr>
<td>Sheepa LU</td>
<td>64.6</td>
<td>239.58</td>
<td>243</td>
</tr>
<tr>
<td>% OJ</td>
<td>80</td>
<td>18</td>
<td>83</td>
</tr>
<tr>
<td>% BG</td>
<td>20</td>
<td>82</td>
<td>17</td>
</tr>
<tr>
<td>Goata c</td>
<td>5.96 (SD=7.35)</td>
<td>13.92 (SD=9.6)</td>
<td>45.8 (SD=24.51)</td>
</tr>
<tr>
<td>Bovinsa</td>
<td>0.66 (SD=1.11)</td>
<td>0.17 (SD=0.39)</td>
<td>1(SD=1.52)</td>
</tr>
<tr>
<td>Feed (FU/breeder/year)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>25815</td>
<td>72375</td>
<td>103514</td>
</tr>
<tr>
<td>barley</td>
<td>15594</td>
<td>51941</td>
<td>71552</td>
</tr>
<tr>
<td>Wheat bran</td>
<td>6519</td>
<td>16 765</td>
<td>23318</td>
</tr>
<tr>
<td>alfalfa hay</td>
<td>1970</td>
<td>3 198</td>
<td>7331</td>
</tr>
<tr>
<td>DSB</td>
<td>1720</td>
<td>343</td>
<td>588</td>
</tr>
<tr>
<td>Wheat straw</td>
<td>12</td>
<td>127</td>
<td>725</td>
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<tr>
<td>Average fattening livestocka</td>
<td>13.87</td>
<td>50.45</td>
<td>106.1</td>
</tr>
<tr>
<td>Fertility rate (%)</td>
<td>95</td>
<td>75</td>
<td>84</td>
</tr>
<tr>
<td>Fecundity rate (%)</td>
<td>87</td>
<td>87</td>
<td>87</td>
</tr>
</tbody>
</table>

*a livestock unit, b fodder unit, OJ: Ouled Djellal, BG: Beni Guil; DSB: Dry sugar beet
Discussion

In our study, the typology of the breeding system was based on several variables, mainly the feeding management which generate three groups of breeders. However, this classification is also observed by Bechchari et al. (2014) in Ain Beni Mathar and Mâatarka but based on the livestock size. The farmers adopt variable management of their herds according to their socio-economic status. The first group is called herders of subsistence, with an average livestock size of 27 breeding ewes (SD=10.6). They are passive towards the effects of drought because of their lack of anticipation for this change. Followed by the second group, medium-sized breeders, with 96 ewes (SD=38.8). They are part of the intermediate farms, which consider animal husbandry as a way of subsistence, and it is not consider as a profitable source of income. And finally, the larger farms with an average of 415 ewes (SD=199), aim to make profits and generate profitable capital, particularly in livestock breeding and in other sectors or activities. The same observations obtained by Yabrir et al. (2015) in Algeria where breeders are classified also to three groups according to the importance of the herd size. They explain that small size breeders have less than 100 heads. The average size livestock varies between 100 to 300 heads; and large size farms with more than 300 heads (can achieve 1000 heads and more). The presence of small, medium, and large breeders still exists but the difference in terms of herd size is not significant. While the amount of supplementation purchased presents the factor that could distinguish between different breeding systems in the rural area of Beni Mathar.

The breed composition can also be a criteria to establish a typology. The herds is generally heterogeneous and containing two breeds and even more. The same result has been found by Laoun (2007), on the steppe of Djelfa. He estimated that half of the breeders have two breeds, and 34.62% of them have more than two breeds. In addition to this study, Mohamed et al. (2008) have identified three breeding systems based on the ownership of crossbred, purebred animals, and the mix between the two types of breeds. In 2014, Bechchari et al. Have identified, in the high eastern plateaus of Morocco, the ownership of different breeds in same herd. They explain a gradual change of the ratio of breeds among the studied herds. Ouled Djellal (with competitive commercial value) become more dominant to detriment of the local Beni Guil breed. However, Srour et al. (2006) has found that the herds in Lebanon are homogeneous and contain a single breed (Awassi). Livestock systems have undergone a major change with the appearance of cattle breeding on land considered rangeland. Some sheep farmers turn into a milk producer. Milk production is becoming a fundamental issue in the practice of some breeders. This remunerative activity responds to a growing need of breeders for money, investing in the livestock feed, paying the shepherd, truck, or pick-up charges, and modernizing sheep farming (Chatto, 2014).
In Eastern Morocco by northeast, the old tradition of nomadic breeding is declining. Amplification of the sedentarization of populations has taken place (Bonte et al., 2009; Bourbouze, 2006). The decline of pastoral mobility leads to quantitative and qualitative pressures on natural resources (soil, plant cover, water). Despite the decline in mobility of the breeders, the increase in the livestock size has been noticed. However, this observed raise in the number of animals cannot happen without a harmful pressure on pastoral resources, imperatively requiring the feed supplementation of herds (Bechchari et al., 2014).

According to Bechchari et al. (2014), most breeders in Beni Mathar are characterized by using rangelands with low mobility, they choose to settle down, explaining that the consecutive years of drought did not leave of vegetation resources to explore. They rely also on frequent supplementation (from 0.5 to 1 kg/head/day) which covers approximately 40% of the herd needs with 90 LU of whose size is very medium. The most used concentrate feed are barley and wheat bran, which are purchased from different local markets. The breeders also purchase the hay of Alfalfa, dry sugar beet, and wheat straw (Bechchari, 2020) which are the same feed supplementation purchased by the breeders in our study. The importance of using animal concentrate feed is still existing. The feed intake is rich in energy and poor in protein (except in extremely limited cases providing hay of Alfalfa and wheat bran to avoid incidents of bloating). Complementation has become an obligation, the breeders mentioned in many cases that it becomes crucial for their herds to live. It is a crucial component in the competition between breeders to provide better meat production. Indeed, breeders who satisfied their animals need from rangelands only find it difficult to sell them (Chattou, 2014). Kanoun et al. (2007) And Khaldi and Dahlane (2011) observed the same results. They explain that the use of supplementation feed has accentuated especially during the period of low fodder availability and responds to both ecological and economic opportunities. It is common practice among large breeders in semi-arid regions. They are sometimes forced to sell sheep to be able to buy feed, which explains their saying “the ewe eats its sister”. In the steppe environment, supplementation with barley and wheat bran is practiced and becomes more important in autumn and winter (Mouhous, 2007; Douh, 2012; Hadbaoui, 2013). Also, Medouni et al. (2004) and Habdaoui (2013) reported that the concentrate-based supplementation (barley, wheat bran and sometimes maize) is necessary when the rangeland does not cover the animals’ requirements.
Conclusion

This study highlights three types of farming systems, in a context of strong evolution in the use of concentrated feed to the detriment of natural vegetation rangelands, without any significant difference in their breeding strategy. The typology has change from the last study of the pastoral systems, because of various anthropogenic and natural factors mainly the climate change. This updated knowledge encourages to take development measures appropriate to the specific conditions and resources of each system. It also allows to generate specific recommendations for each breeder group based on their feeding management. It will be interesting to choose a breeder from each group to be a subject of feeding management monitoring. The latter will be a chance to observe their use of the rangelands with their regressive dynamic. A similar study should be carried out in the rest of rangelands of the high plateaus of eastern Morocco to learn more about the typology of sheep breeding in this area and how the various changes have affected their feeding management.
Références


