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Feeding practices in sheep stockbreeding in the Algerian steppe (M'Sila region): Current situation and prospects for improvement

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Abstract. The Algerian steppe covers 20 million hectares and is located between the isohyets of 100 and 400 mm/year. It is home to 17 million sheep (MADRP, 2016). For the past 50 years, it has undergone many changes and transformations resulting from the stockbreeding management that contributed to a decline in forage productivity and in the surface area of steppe pastures. Therefore, the steppe pasture covers only 30 to 40% of the animal's feed requirements. To face this situation, stockbreeders are adopting various feeding strategies. Our objective was to assess the feeding practices adopted by the herders in M'Sila region. This region has 1 million ha of rangelands and hosts 1.63 million sheep heads (DSA, 2016). One hundred herders, from the different breeding systems and different pastoral areas, were investigated by technical-organizational approaches. The analysis of field interviews revealed the presence of two feeding calendars, involving different feed sources (concentrate feeds, cultivated forages, and cereal co-products). Although the supplementation with concentrate feeds is a common practice to meet animal needs (about 40% of ration), there are new feeding trends based on the direct consumption of green fodder (barley, oat and alfalfa). The choice of feeding strategies depends on the socio-economic and agricultural considerations of each herder (herd size, financial capacity, farming practice, income diversification, etc.).

Keywords: Agropastoral stockbreeding systems – Steppe rangelands – M'Sila Algeria – Feeding calendar – Feed supplement – Prospects.

Pratiques d'alimentation dans les élevages ovins en steppe algérienne (Région de M'Sila) : Réalité et perspectives d'amélioration

Résumé. Le territoire steppique algérien de 20 millions d'hectares, se délimite entre les isohyètes de 100 et 400 mm/an. Il abrite 17 millions d'ovins (MADRP, 2016). Depuis 50 ans il a connu de nombreuses évolutions et transformations engendrant des conduites d'élevage qui contribuent à une baisse de la productivité fourragère et de la surface des pâturages steppiques. Ainsi, la pâture steppique couvre seulement 30 à 40% des besoins alimentaires des animaux. Pour faire face à cette situation, les éleveurs adoptent diverses stratégies alimentaires. Notre questionnement s'intéresse aux pratiques et modalités d'alimentation adoptées par les éleveurs de la région de M'Sila. Cette région compte 1 million d'ha de parcours et 1,63 million d'ovins (DSA, 2016). Cent éleveurs des différents systèmes d'élevage et de différentes zones pastorales ont été enquêtés par approches technico-organisationnelles. L'analyse des données d'entretien révèle la présence de deux calendriers alimentaires, avec différentes ressources fourragères (aliments concentrés, fourrages cultivés, et sous-produits de la céréaliculture). Bien que l'apport en aliments concentrés relève d'une pratique récurrente pour satisfaire les besoins des animaux (soit environ 40% de la ration), il existe de nouvelles tendances alimentaires basées sur les fourrages cultivés et consommés généralement en vert (orge, avoine et luzerne). Le choix des stratégies alimentaires dépend de considérations socio-économiques et agricoles propres à chaque éleveur (taille de troupeau, capacité financière, pratique de l'agriculture, diversification des revenus, etc.).

Mots-clés. Systèmes d'élevage agropastoraux – Parcours steppiques – M'Sila Algérie – Calendrier alimentaire – Complément alimentaire – Perspectives.

I – Introduction

The Algerian steppe territory (located between isohyets 100 and 400 mm) extends over 20 million hectares (Aidoud *et al.*, 2006). It hosts mainly sheep pastoral activities (Nedjraoui, 2004) with 17 million sheep heads (62% of the national sheep flock (MADRP, 2016) and 13 million hectares of grazing land (Aidoud *et al.*, 2006). Pastoral activities has allowed to live until now the steppe population (Bencherif, 2018).

However, the rangelands which were the main feed source for the sheep flocks suffered from a severe degradation. Nowadays 80% of rangelands are declared degraded (HCDS, 2010). Several factors have contributed to the impoverishment of rangelands, the most significant being: the population growth, the increase in the number and size of sheep flocks, cultivation of rangelands, a new habitat's mode, socio-cultural changes, and recurrent and extended droughts.

Confronted to the scarcity of natural fodder, herders are in a permanent uncertainty about how to ensure enough feed for their animals. Therefore, stockbreeders are adopting different strategies. Our study aimed to define and analyse the feeding strategies of sheep herders and to estimate diet composition across the year. A question arises as to whether these strategies are short-term opportunistic practices or can be resilient in the long term.

II – Materials and methods

The methodology adopted in the current study is based on technical and organizational interviews. We conducted interviews with a sample of 100 stockbreeders representing various existing live-stock systems and different pastoral areas of the Wilaya (Department). In addition to interviews, the collection of statistics from agricultural and grazing managements services was necessary to complement the field data.

The M'Sila region was chosen for the study on criteria related to animal numbers and pastoral areas (1.63 million sheep heads, 1 million hectare of rangelands) (DSA, 2016).

III – Results and discussion

1. Breeders' classes

The most relevant classification criterion is the size of the sheep flock owned. We classified herders into four groups (Table 1). Stockbreeders whose flock's size was less or equal to 500 heads, i.e. classes I, II and III represent 91% of the whole sample, and own 61% of the total sheep stock. On the other hand, class IV (flock size between 501 and 1950 heads) although representing only 9% of the breeders, owns 39% of the total sheep stock.

In other words three fifth (3/5) of the sheep are owned by "small owners" and "middle owners" (Classes I, II and III), while the breeders described as "big owners" (class IV) have two fifths (2/5) of the sheep stock.

Table 1. Classification of breeders interviewed according to the size of their sheep flocks

Classes	No. of herders	(%)	Total sheep	(%)
Class I (\leq to 100 heads)	17	17%	1 283	4%
Class II (101-200 head)	35	35%	5 436	18%
Class III (201-500 head)	39	39%	11 815	39%
Class IV (501-1950 heads)	9	9%	11 813	39%
Total	100	100%	30,347	100%

2. Feeding calendars

The feeding calendar is a simple schematic representation of the utilisation frequencies of different feed resources across the year. The analysis of our interviews put forward two different feeding calendars:

- The first concerns breeders of the first three classes (I, II and III), who share the same utilisation frequencies of the different feed resources (Fig. 1).
- The second calendar concerns breeders of class IV (Fig. 2) and is characterised by a different utilisation frequencies of feed resources when compared to the previous classes, especially:
 - A limited reliance on rangelands: 6 months of use against 12 months for calendar(1);
 - An insignificant use of hay and straw (does not even appear in the calendar);
 - Higher use of fallows, which do not appear in calendar (1).

classes I+II+III	Sep	Oct	Nov	Dec	Jan	Feb	March	April	May	June	July	August
Rangelands												
Concentrated feed												
Hay+straw												
Green fodder												
Stubble+cereals disastered												

Fig. 1. Feeding calendar (1) of breeders classes I, II and III.

classe IV	Sep	Oct	Nov	Dec	Jan	Feb	March	April	May	June	July	August
Rangelands												
Concentrated feed												
Green fodder												
Stubble+cereals disastered												
Fallow												

Fig. 2. Feeding calendar (2) of breeders class IV.

3. Diet composition

The calculation of diet composition shows the contribution of each feed resource to the satisfaction of flock's feed requirements. To estimate diet composition for the 100 herders along the year 2018 (year of the interviews), we performed individual calculations of diet composition for each breeder. We used the quantities and surfaces of the different feed resources used by the herders, and their estimated energy content expressed as forage units (UF). The reference values used for our feed calculations are summarized in Table 2. Furthermore, the contribution of rangeland biomass in the diet was calculated as the difference between total herd requirements and the energy provided by the other feed sources. Discussions with herders allowed us to approximate feed rations, under the hypothesis that the animal's needs are fully met.

The estimation of animal's requirements was achieved by the conversion factors proposed by Moskal (1983). These coefficients were adapted to the characteristics of the Algerian flocks. Converting herd's numbers into livestock units then UF allowed to homogenize the needs of animals

and feed intake. Additional requirements, accounting for grazing expenses, were included. Thus, the requirements were increased by 20% for the herders who did not use rangelands, and by 50% for the herders who used rangelands (CIRAD, 2002).

Table 2. Values of different feed resources

Type of feed	Nutritional value (UF / Unit)	Type of feed	Nutritional value (UF / Unit)
Barley ¹	0.94 UF / kg crude material	Stubble ³	300 UF / ha
Wheat bran ¹	0.74 UF / kg crude material	Disastered cereals ³	500 UF / ha
Soft wheat ¹	1.05 UF / kg crude material	Fallow ³	325 UF / ha
But ¹	1.09 UF / kg crude material	Straw and hay ³	UF 0.33 / Kg, 25Kg / haystack
Barley green ²	1836 UF / ha		
Oats green ²	3832 UF / ha		
Alfalfa green ²	1743 UF / ha 1st cycle		
	1581 UF / ha 2nd cycle		
	1625 UF / ha 3rd cycle		
	1099 UF / ha 4th cycle		

¹(INRA (Fr), 2018) (our calculations); ²(Kerbaa, 1980); ³(CIZ / SYFEL, 2004).

There was a similarity in diet composition between herders of feeding calendars 1 and 2. This resemblance in dietary intake may be explained by the low contribution of the resources making the difference between both calendars (hay, straw, and fallow). The contributions of feeds to the total requirements of livestock are presented in Table 3.

Table 3. Contributions of feeds in livestock diets

	Intake (UF)	Percentage
Concentrated feeds	4,220,511	39.81%
Rangelands	2,923,933	27.58%
Green fodder (barley, oat, alfalfa)	1,802,878	17.00%
Stubble and disastered cereals	1,162,000	10.96%
Hay and straw	321,255	3.03%
Fallow	171,275	1.62%
Need's total	10,601,852	100%

Concentrated feeds make the highest contribution to the diet (39.81%); they constitute the basis of feeding in current stockbreeding systems. This confirms the current reality of the steppe, pointed out by scientists, with the transition from grass-based to concentrated-based feeding systems (Senoussi *et al.*, 2014). The concentrate feeds become the basic ration, and rangelands become supplements (Aidoud *et al.*, 2006). This feeding mode based on concentrate feeds has limits. A technical limitation is the physiology of the animal : sheep are ruminants that need fiber in their diet. An economical limitation is the cost of sheep meat production (about 10€/ kg) which is too high and uncompetitive in front of international sheep meats (hence the heavy customs taxes on the import of animals).

The rangelands that used to be the main feed source for animals in the past, currently contribute only by 27.58% of the ration; this resulted from their severe degradation, caused mainly by overstocking (Senoussi, 2014). However, we identified new feeding practices adopted by herders to fill the fodder deficit, and especially forage crops (barley, oat, alfalfa) used in green and covering 17% of animal needs.

Other forage resources represent a significant part of the animals' diet (10.96%). They are mainly stubble and disastered cereals (cereals grown without irrigation and grazed on foot when yields are low). The remaining needs are covered by hay, straw and fallow land (4.65%).

While the overall analysis shows that the intake of concentrate feeds represents the main part of the animal diet, more refined analyzes suggest a diversity of strategies. We notice that :

- 17% of herders cover more than 50% of the animal's requirements with concentrate feeds (it can go up to 91%);
- 12% of herders are still relying on range vegetation, which covers between 50% and 80% of the diet;
- 12% of herders cover more than half of the animal's requirements (up to 80%) with green fodder, mainly barley and to a less extent oat and alfalfa, which are grown in irrigated conditions.

IV – Conclusion

Feeding calendars adopted by breeders reflect the importance to rely on alternative feed resources, to rehabilitate rangelands and to reduce the use of expensive concentrate feeds. However, herders react in an individual way, each according to its material and financial capacity. In the current conditions, the stockbreeding systems are vulnerable and feed shortage is prevailing. It should also be noted that at present herders have no intention to preserve the rangelands, hence the need to establish an integrated development strategy for environment, agriculture and livestock, and even other adjacent economic activities (crafts, agro-industrial processing, etc.).

It is recommended to establish a shared vision of development so that the development strategies can implement various integrated options (e.g. rehabilitation steppe rangelands, water management, forage promotion programs).

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