

Contribution to Knowledge of Food Formulation during Lean Periods in the Provinces of Wadi-Fira and West-Ennedi (Chad)

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Abstract

The effects of climate change have had a major impact on forage availability in the Sahel and Saharan regions of Chad in recent years. This has led to the migration of farmers in search of long-distance grazing, thus impacting the potential of the animals to produce good quality milk and meat. It is with this in mind that this study was conducted on the knowledge of feeding practices of animals in the provinces of Wadi-Fira and West-Ennedi (Chad) during the lean period. More specifically, it is a question of collecting some information on the plants consumed by the animals and the way in which the breeders formulate the food ration of their herds in times of deficit. It emerges from this investigation that the herds of animals in the province of Wadi-Fira faced with forage deficit and adapted by consuming the leaves, fruits and seeds of certain tropical plants such as *Capparis decidua*, *Ziziphus mauritiana*, *Balanites aegyptiaca*, *Acacia tortilis*, *Boscia senegalensis*, *Salvadora persica* and *Tribulis terrestris* to compensate for food shortages. This same observation was made in the province of West-Ennedi, since this area is desert with annual precipitation of 150 mm. Natural pasture is only available around water points (ouadis and oasis) in a small area with a high number of herds. Thus, the herds also face a drastic lack of grazing during the deficit periods. However, they adapt by consuming the leaves, fruits and seeds of plants such as *Bauhinia sp.*, *Boscia senegalensis*, *Acacia tortilis*, *Tribulis terrestris*, *Boscia angustifolia*, *Bicoma tomentosa*, *Blepharis linarifolia* and *Aristida funiculata* during lean periods to meet their food requirements. The formulation of the feed ration for animals differs from one area to another. It is mainly based on residues from cereals such as millet (*Panicum miliaceum*) and sorghum (*Sorghum bicolor*).

Keywords

Grazing, Food Formulation, Lean Period, Natural Resources

1. Introduction

A Sahelian country with a pastoral vocation, Chad largely bases its economy on the valorization of livestock products, despite the advent of oil. The second source of income after oil, the share of livestock in the national Gross Domestic Product (GDP) is 53% and sustains about 40% of the population [1]. This activity remains one of the mainstays of the economy and an important source of dividends in the socio-economic development of the country. This breeding is therefore confronted with enormous difficulties linked especially to food which constitutes one of the most important limiting factors of animal production. In Chad, livestock farming is extensive and livestock feeding is mainly based on the use of natural pastures. Current population estimates range from 10 to 16 million UBT (tropical livestock unit). 80% of this livestock is managed by pastoral systems characterized by extensive production, the mobility of which constitutes a production and risk management strategy [2]. However, these animals draw most of their food from natural rangelands and encounter difficulties during the dry season in expressing their potential [3].

These forage resources have nutrient values that deteriorate rapidly with age during the dry season [4]. In addition, these natural resources have poor food value because they are rich in cellulose but low in nitrogen, minerals and vitamins [5]. This does not allow animals to properly produce and predispose them to various diseases [6] [7].

During the rainy season, forage availability is important in some areas of Wadi-Fira. On the other hand, in the province of West Ennedi, the precipitations are weak with annual precipitation of 150 mm [8]. In both provinces, in the dry season, forage is significantly reduced. During this period, only straw of low nutritional value remains which does not manage to cover the maintenance needs of the animals, causing significant reductions in production.

It is within this framework that this study on the contribution to the knowledge of the food formulation to compensate for the lack of food during the deficit periods in the provinces of Wadi-Fira and West Ennedi was initiated.

To do this, surveys were conducted through a series of questionnaires for livestock farmers in both localities to collect some information on the plants consumed by the animals and how farmers formulate the feed ration of their herds in times of deficit.

2. Materials and Methods

➤ Study site

The study took place in the provinces of Wadi-Fira and West Ennedi (**Figure 1**)

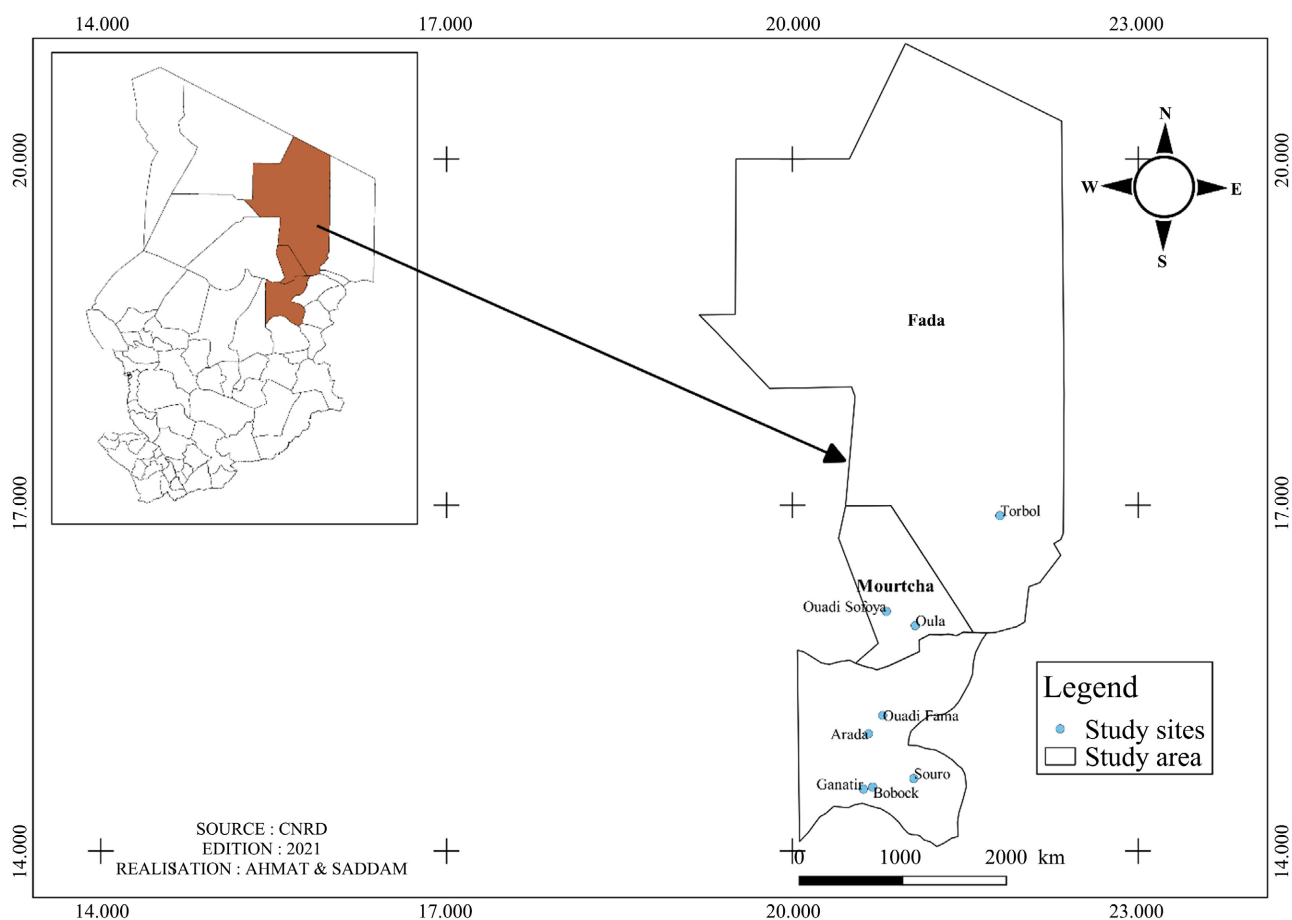


Figure 1. Location of study area.

between April and May during the lean period. The purpose of this study is to provide as much information as possible on the different food formulation methods used in both provinces to offset food shortages during periods of food deficit. To carry out this work, an investigation sheet was designed to collect some precise information. We established eight survey sites in both provinces (Wadi Fira and Ennedi). In addition, it is also planned to collect a body of knowledge mainly on plants consumed by animals and food formulation combinations used during lean periods.

➤ Data collection and analysis

The information was obtained during the working sessions held with the heads of the provincial livestock delegations and the Regional and Departmental Veterinary Services in order to have a general description of the situation of the cattle feeding in the two provinces (Wadi-Fira and Ennedi-West). These data are supplemented by those recorded during the Semi-structured Interviews (SSI) conducted with farmers in the villages visited. The main questions asked during the interviews are related to:

- ✚ The nutritional status of the animals and the forage plants they consume at the time of forage deficit;
- ✚ The parts of the plant consumed by the animals;

- ✚ And the local food formulation is used to compensate for the lack of food during the lean period.

The results produced in this study are mainly based on questionnaire analysis.

3. Results and Discussion

These results concern the points previously announced as the fodder used by animals during periods of deficit, the plant organs consumed by animals and the formulation of local foods used in the eight (8) localities of the two provinces (Wadi Fira and Ennendi west) described as follows.

3.1. Wadi Fira Province

The survey was conducted in the biltine department in five (5) areas as follows: (Table 1).

3.1.1. Bobock

Bobock is a locality located 15 km from the town of Biltine. In this area, the breeding is sedentary type. The livestock consists mainly of cattle, goats, sheep and there are also some camels. Their diet is mainly based on natural resources during periods of forage availability. During the lean season, their animals are fed on straws that have been mown and preserved, as well as the leaves, fruits and seeds of some tropical forage plants that are resistant to water stress. A few local food formulations are also used to feed a limited number of animals. Table 2 lists the main forage crops consumed by animals during the lean period in this locality.

According to the results obtained in Table 2, the herds of animals in the locality of Bobock are fed on the natural range during the lean times and the main consumed parts of these plants are the leaves and the fruits. However, plants like *Salvadora persica* and *Capparis decidua* are the most palatable plants for animals.

✚ Local food formulation:

To compensate for the lack of food during the dry periods when nature offers almost nothing to the animals and the plants consumed lose their leaves, the food formulation used in this zone is focused on the use of cereal bran, white sorghum, the straw of penicillary millet and sometimes cotton or peanut meal to feed the animals.

3.1.2. Ganatir

Located 25 km from the town of Biltine in the department of Biltine, this locality is co-located by herders of Mimi and Arab ethnic groups. The type of farms found in this area is characterized by a sedentary breeding system (the case of mimi breeders) and a nomadic breeding system (the case of Arab breeders). Their herds consist of camels, cattle, sheep and goats. During the lean periods these herds consume the mown straws and store either the leaves, seeds and fruits of the plants encountered in as summarized in Table 3 below:

Table 1. Localities investigated in Wadi-fira province.

N°	Localities	Latitude	Longitude
01	Bobok	14°33'N	20°42'E
02	Ganatir	14°53'N	20°61'E
03	Souro	14°62'N	21°05'E
04	Arada	15°01'N	20°64'E
05	Ouadi fama	15°11'N	20°50'E

Table 2. Names of plants consumed by animals during subhard periods in Bobok.

N°	Local name	Scientific name	Part consumed	Period consumed
01	Toumtoum	<i>Capparis decidua</i>	Leaves/flower	Rainy season- start Dry season
02	Nabag	<i>Ziziphus mauritiana</i>	Leaves/Fruits	rainy season
03	Hidjilite	<i>Balanites aegyptiaca</i>	Leaves/Fruits	dry season
04	Chaou	<i>Salvadora persica</i>	leaves	dry season

Table 3. Names of plants consumed by animals during the dry season in Ganatir.

N°	Local name	Scientific name	Part consumed	Period consumed
01	Am darab	<i>Boscia angustifolia</i>	Leaves	dry season
02	Toumtoum	<i>Capparis decidua</i>	Leaves/flower	Late rainy season
03	Chaou	<i>Salvadora persica</i>	Leaves	dry season
04	Hidjilite	<i>Balanites aegyptiaca</i>	Leaves/Fruits	dry season
05	Nabag	<i>Ziziphus mauritiana</i>	Leaves/Fruits	rainy season

The results of **Table 3** show that during the dry season herds of animals made up of sheep, goats and camels consume the most appreciated plants such as *Capparis decidua*, *Salvadora persica* and *Ziziphus mauritiana* to meet their food needs. The most consumed parts of these tropical plants encountered in the natural range are the leaves and fruits.

✚ Local food formulation:

The management of the lean period spread over about 4 months from mid-March to the beginning of July is characterized by a lack of food in the natural range. This deficit period is offset by the creation of a local food formulation consisting of millet straws stored after harvest, millet bran, white sorghum, groundnut meal and/or cotton meal.

3.1.3. Souro

Located at the foot of the mountain in the province of Wadi-Fira department of Biltine. Souro is a locality of the breeders of the Gourane ethnic group who came from the Ennedi-Ouest 42 years ago by following the water and the pasture but who finally settled in this zone. The breeding system encountered in the locality

is of the edentary type, where breeding is associated with agriculture. Animal herds consist of cattle, goats, sheep and camels. The latter are fed mainly on natural foraging which constitutes the basis of their diet. However, during periods of forage shortage, these animals are fed on a local basis, either by the leaves, fruits and seeds of certain fodder crops summarised in **Table 4** below.

Table 4 summarizes the tropical plants encountered on natural rangelands and consumed by animals. The most appreciated by livestock are *Balanites aegyptiaca*, *Ziziphus mauritiana*, *Salvadora persica* and *Bauhinia sp.* The leaves and flowers of these plants constitute the food base of their flocks. These leaves and fruits are pruned by breeders to feed their livestock.

✚ Local food formulation:

In this area, the breeders do not have a specific food formulation but are content with some crop residues such as millet straws, bran, peanut shell, white sorghum, small millet, Cotton and/or peanut meal to compensate for the lack of food and to cope with the lean periods.

3.1.4. Arada

The locality of Arada has located 65 km from the town of Biltine in the province of Wadi-Fira department of Al-biyer. In this area, the type of breeding encountered is especially the transhumant pastoral system and the agro-pastoral system. Since the natural environment of the arada locality is difficult from pastoral areas where livestock feeding is based on extensive grazing, transhumance is sometimes the best-adapted breeding system for the locality's breeders. Their herds consist of camels, cattle, sheep and goats. They consume the leaves, fruits and seeds of some forage plants during lean periods as summarized in **Table 5** below.

Table 5 shows that, in order to cope with feed shortages during periods of forage shortage, herds of animals consume the leaves and fruits of tropical forage plants as indicated in the table above. However, plants with a high level of appetites, such as *Salvadora persica*, *Capparis decidua*, *Boscia angustifolia* and *Mesua Crassifolia* are the most appreciated animals.

✚ Local food formulation:

In fact, during lean periods when forage is scarce and the leaves of plants turn

Table 4. Names of plants consumed by animals during the lean period in Souro.

N°	Local name	Scientific name	Part consumed	Period consumed
01	Arkenlouhou	<i>Bauhinia sp.</i>	leaves	dry season
02	Salaye	<i>Acacia tortilis</i>	Leaves/Fruits	rainy season
03	Garate	<i>Acacia nilotica</i>	Leaves/Fruits	Late rainy season
04	Chaou	<i>Salvadora persica</i>	leaves	dry season
05	Hidjilite	<i>Balanites aegyptiaca</i>	Leaves/Fruits	dry season
06	Andressa	<i>Tribulus terrestris</i>	leaves	rainy season
07	Nabag	<i>Ziziphus mauritiana</i>	Leaves/Fruits	rainy season

Table 5. Names of plants consumed by animals during the lean period in Arada.

N°	Local name	Scientific name	Part consumed	Period consumed
01	Kourmout	<i>Maerua crassifolia</i>	Leaves/Fruits	dry season
02	Toumtoum	<i>Capparis decidua</i>	Leaves/flower	rainy season
03	Mikhette	<i>Boscia senegalensis</i>	leaves	dry season
04	Chaou	<i>Salvadora persica</i>	leaves	dry season
05	Am darab	<i>Boscia angustifolia</i>	leaves	dry season
06	Andressa	<i>Tribulis terrestris</i>	Leaves/flower	rainy season
07	Nabag	<i>Ziziphus mauritiana</i>	Leaves/Fruits	dry season
08	Hidjilitte	<i>Balanites aegyptiaca</i>	Leaves/Fruits	dry season

yellow and fall, farmers feed their herds through combinations of food formulations such as cotton and/or peanut meal, and millet straws to compensate for food shortages.

3.1.5. Ouadi Fama

Located 27 km from the town of Arada in the province of Wadi-Fira department of Al-biyer. Ouadi fama is a locality that gathers several breeders living in the surrounding ouadi around a watering point. The breeding system encountered in the Ouadi fama area is of sedentary type and weak transhumance according to the rainy periods. In this locality, the main source of feed for livestock remains natural pastures and crop residues, which are heavily dependent on rainfall. The herd consists of herds of camels, cattle, sheep and goats. During the lean period, these herds consume the leaves, fruits and seeds of the forage plants listed in **Table 6** below.

According to the results obtained in **Table 6**, the fodder plants encountered in the pasture areas in the locality of Ouadi fama as listed below are the food base of the animals during the dry season. The parts of these plants consumed by the animals are the leaves and fruits and the plants most appreciated by the latter are *Salvadora persica*, *Boscia angustifolia* and *Capparis decidua*.

✚ Local food formulation:

During periods when forage plants lose their leaves and the environment offers almost nothing to the animals, the latter are fed by a combination of ingredients such as peanut cake, cotton cake, white sorghum, cereal bran and millet flour. The millet flour will be added to the natron and then mixed in the drinking water and fed to the animals. All these local food formulations are made to cope with the periods of loss and allow the animal to compensate for the energy lost during long-distance movements in search of water and grazing.

The province Wadi-Fira is a semi-desert area with hydrography marked by insufficient rains and their misallocation in time and space. However, in the rainy season the dry valleys receive the waters of the ouadis and note the existence of some temporary pools where the livestock come to drink. In the dry season, feeding animals is a real problem for farmers in this area. During dry

Table 6. Names of plants consumed by animals during the dry season in Ouadi fama.

N°	Local name	Scientific name	Part consumed	Period consumed
01	Toumtoum	<i>Capparis decidua</i>	leaves/Flower	rainy season
02	Nabag	<i>Ziziphus mauritiana</i>	Fruits	rainy season
03	Am darab	<i>Boscia angustifolia</i>	leaves	dry season
04	Chaou	<i>Salvadora percica</i>	leaves	dry season
05	Mikette	<i>Boscia senegalensis</i>	leaves	dry season

periods, their herds are fed mainly on rangelands during periods of forage existence in some localities of the province around the oases and temporary pools. These assessments are supported by the results of Raemaekers [9], which states that rangelands constitute the food base of cattle, goats and sheep in general around the world. It was also reported by Traoré EH [10], in Senegal, that the well-stocked natural range in the southern and eastern regions is the main food source for animals throughout the Kolda and Sédhiou areas. In some localities of the province of wadi fira, at certain times of the year when the rangelands are overexploited or insufficient, the breeders use the leaves, seeds and fruits of certain plants to feed their herds. This result corroborates that of Mbow [11] in Senegal, who reports that due to the deterioration of pasture, some trees are pruned by breeders to feed their animals.

3.2. Ennedi Province

The areas of the Province of West Ennedi covered by the study are divided into the following areas (Table 7).

3.2.1. Torboul

Torboul is a prefecture located 80 km from the town of Kalait in the province of Ennedi-west, department of Torboul. The breeding system encountered in the locality is a sedentary and semi-transhumant type for torboul breeders with seasonal transhumance where the natural course remains the main source of food for their herds. However, there is also transhumance of breeders from nearby localities who come in search of water and graze around the temporary Torboul pond. This place of watering almost unites the breeders to the surroundings and even beyond Torboul. The herds encountered in this area consist of camels, sheep and goats. They consume the leaves, fruits and seeds of plants as indicated in Table 8 below.

Table 8 shows the results of forage plants consumed by animals during the deficit periods. It follows from this picture that during the moments of lack of forage, the leaves, flowers and fruits of the fodder plants encountered in the area are pruned to give animals in order to ensure a suitable and continuous diet throughout the period of lean. Among these fodder plants most used by animals are *Capparis dicitua*, *Boscia angustifolia*, *Dicoma tomentosa*, and *Salvadora percica*.

Table 7. Localities investigated in West Ennedi province.

N°	Localities	Latitude	Longitude
01	Torboul	15°95'N	21°62'E
02	Oula	15°95'N	21°06'E
03	Ouadi sofoya	14°31'N	20°49'E

Table 8. Names of plants consumed by animals during the dry season in Torboul.

N°	Local name	Scientific name	Part consumed	Period consumed
01	Arken	<i>Bauhinia</i> sp.	leaves	dry season
02	Tehi	<i>Acacia tortilis</i>	leaves/fruits	dry season
03	Kosom	<i>Capparis dicidua</i>	Leaves/flower	dry season (cold period)
04	Chaou	<i>Salvadora percica</i>	leaves	dry season
05	Modou	<i>Boscia senegalensis</i>	Fruits	dry season
06	Kohoul	<i>Boscia angustifolia</i>	leaves	dry season
07	Dirguichie	<i>Boscia</i> sp.	leaves	dry season
08	Esri	<i>Dicoma tomentosa</i>	Flower/leaves	dry season

✚ Local food formulation:

In view of the lean period, farmers in the locality of Torbol have a local food formulation consisting of groundnut meal and/or cotton, white sorghum, millet bran and white sorghum flour mixed with natron and fed into the drinking water. This combination of ingredients is intended only for feeding small ruminants. On the other hand, camels make walking hours in search of grazing on the natural pastures.

3.2.2. Oula

Located in the province of Ennedi-west department of mourtcha, this locality is 30 km from the town of Kalait. The breeding system encountered in this desert locality is of two (2) types; a part of the breeders is sedentary (especially women and elderly) and another part of the nomadic breeders follow the pasture surfaces around the ouadi and oasis. Their herds consist of camels, goats, sheep and a few cattle.

The availability of fodder in this desert area of Oula is almost non-existent even if the quantity of fodder depends on the pluviometry, it is overexploited because of the high number of herds for a limited grazing area. For this reason, their herds consume during the deficit periods the leaves, fruits and seeds of some forage plants encountered on the natural course. These plants are grouped in **Table 9** below.

Table 9 shows the results obtained during our investigations into the plants encountered on natural farms and used as livestock feed during the loss periods. The forage plants most used by the animals are *Boscia angustifolia*, *Cymbopogon proximus*, *Capparis dicidua*, *Acacia tortilis*, *Bauhinia* sp., and *Salvadora percica*. The consumed parts of these plants are leaves, fruits and flowers.

Table 9. Names of plants consumed by animals during the period of subhard in Oula.

N°	Local name	Scientific name	Part consumed	Period consumed
01	Yohour	<i>Cymbopogon proximus</i>	leaves	dry season
02	Tehi	<i>Acacia tortilis</i>	Leaves/Fruits	dry season
03	Arken	<i>Bauhinia</i> sp.	leaves	dry season
04	kosom	<i>Capparis didicua</i>	Leaves/flower	dry season (cold period)
05	Modou	<i>Boscia senegalensis</i>	leaves	dry season
06	Gohour	<i>Blepharis linariifolia</i>	Leaves/flower	dry season
07	oyou	<i>Salvadora perica</i>	leaves	dry season
08	Esri	<i>Dicoma tomentosa</i>	Fruits	dry season
09	Olow	<i>Balanites aegyptiaca</i>	Leaves/Fruits	dry season
10	Kohoul	<i>Boscia angustifolia</i>	leaves	dry season (cold period)

✚ Local food formulation:

During periods of forage availability, pasture areas are only available around ouadi and pastoral water points. In the dry period, farmers in the Oula locality have a food formulation composed of some combinations of ingredients that can be obtained according to their means on the markets. These ingredients include groundnut and/or cotton meal, white sorghum, cereal bran and millet flour mixed with natron and added to the drinking water and then fed to the animals to cover maintenance needs during lean periods.

3.2.3. Ouadi Sofoya

Ouadi sofoya is a ferrick of sedentary and nomadic breeders located at the northern exit of kallait about 20 km. In this desert locality of the province of Ennedi west, the herds of animals encountered in this area are mostly camels, goats and sheep but also some rare cattle. In this part of the department of Mourtcha, the availability of fodder in the area is dependent on the number of herds in the region, but it is often overexploited because of the high number of herds with a reduced area of pasture. Thus, during the lean periods, the animals consume the leaves, seeds and fruits of the forage plants encountered on the rangelands as grouped in **Table 10** below.

This table shows the results obtained on forage plants consumed by animals during the dry season in the locality of Ouadi sofoya. From this table we remember that the plants encountered in the natural range and the most appreciated by livestock are among others *Blepharis linearifolia*, *Balanites aegyptiaca*, *Aristidia pallida*, *Grewia tenax* and *Boscia angustifolia*. The parts consumed are leaves, flowers and fruits.

✚ Local food formulation:

To compensate for the lack of food offered by nature especially in dry periods, ouadi sofoya breeders make a food formulation consisting of peanut meal and/or cotton, white sorghum, millet, and millet flour mixed with natron and introduced

Table 10. Names of plants consumed by animals during the deficit period in Ouadi sofoya.

N°	Local name	Scientific name	Part consumed	Period consumed
01	Mallé copti	<i>Aristida funiculata</i>	leaves	rainy season
02	Esri	<i>Dicoma tomentosa</i>	Leaves/Fruits	dry season
03	Guihichi	<i>Non identifié</i>	leaves	dry season
04	kosom	<i>Salvadora percica</i>	leaves	dry season (cold period)
05	Morkou	<i>Aristidia pallida</i>	leaves	dry season
06	Gohour	<i>Blepharis linearifolia</i>	Leaves/Fruits	dry season
07	Tehi	<i>Acacia tortilis</i>	Leaves/Fruits	dry season
09	Olow	<i>Balanites aegyptiaca</i>	Leaves/Fruits	dry season
10	Kohoul	<i>Boscia angustifolia</i>	leaves	dry season (cold period)
11	Nergui	<i>Grewia tenax</i>	Fruits	rainy season
12	Modou	<i>Boscia senegalensis</i>	leaves	Saison sèche

into the drinking water before data to the animals. This food formulation is reserved only for small ruminants since their numbers are not so great. On the other hand, camels walk for hours in search of food on the natural range.

The province of Ennedi west is a pastoral area located at the border of the Sahara and the Sahel. This province suffers from deficit and rainfall irregularity. Thus, feeding animals is a real problem for farmers, especially during dry periods. Animals graze around the few water points available around oases and oases, sometimes causing animals to overload the grazing areas. Faced with these major challenges of feeding their herds, the local breeders try to find ways and means necessary to feed their livestock. Many efforts have been made in this respect, such as the preservation of forage in the form of hay or the local formulation of food with ingredients that can be obtained on the market according to their means. However, the main source of feed for the livestock is the range, which is distinguished by vegetation dominated by shrubs forming the natural ecosystem where animals derive most of their feed. Thus, the livestock system best suited in these areas to save livestock during periods of forage deficit is characterized by the mobility of animals to places where there is plenty of water and grazing. Mowing and stockpiling forage in the form of straw or hay for use during lean periods is also an alternative to feed shortages. The exploitation of these pastures is done without the cattle being fixed: nomadism with seasonal transhumance. This assertion is confirmed by Hanse and Jahnke [12], who reported that in arid areas, rangeland exploitation is based on a flexible form of extensive transhumance threatened by overgrazing syndrome. According to Harvad duclos [13], one of the primary characteristics of this natural exploitation is overload, with all the consequences it could have on livestock and on vegetation (which can disappear completely from the course grounds in regions with very long dry season).

4. Conclusion

The present work consists of an inventory of animal feeding practices in the provinces of Wadi-Fira and Ennedi-Ouest, by providing some information on the plants consumed by the animals and the local food formulation intended for the flocks during deficit periods. At the end of this investigation, it emerges that livestock feeding is one of the major challenges for livestock producers in the two (2) provinces, although it is considered an important factor in the improvement and development of livestock production. Rangelands are the primary feed resource for livestock during the forage availability period, although they are not abundant and diversified in the provinces investigated. Thus, during the periods of soldering, the leaves, fruits and seeds of some forage plants most appreciated by the animals encountered in the natural range, such as *Blepharis linearifolia*, *Balanites aegyptiaca*, *Grewia tenax*, *Boscia angustifolia*, *Capparis didyca*, *Acacia tortilis*, *Bauhinia sp.*, *Salvadora persica*, *Dicoma tomentosa*, *Ziziphus mauritiana*, *Aristida pallida*, *Cymbopogon proximus* and *Maerua Crassifolia* are pruned to feed cattle. In order to cover the maintenance needs of animals who walk for hours in search of water and grazing during dry periods, some local food formulations are used, such as millet straws and cereals bran, peanut hulls, groundnut or cotton meal, white sorghum, millet and millet flour mixed with natron and fed into drinking water before data to herds.

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Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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