

## PRELIMINARY NUTRITIONAL CHARACTERIZATION OF SOME SHRUBS (*ATRIPLEX HALIMUS*, *ACACIA CYANOPHYLLA*, *MEDICAGO ARBOREA*, *OPUNTIA FICUS INDICA*) FROM THE NORTH OF TUNISIA

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### ABSTRACT:

The chemical composition, fiber content and nutritional values of four fodder shrubs in northern Tunisia namely, *Atriplex* (*Atriplex halimus*), *Acacia* (*Acacia cyanophylla*), spineless cactus (*Opuntia ficus indica*, var. *inermis*) and *Medicago arborea*, were determined in order to characterize nutritionally for their use in food in small ruminants. *Atriplex halimus* this content Crude protein (CP) highest (20.4% DM), *Acacia cyanophylla* and *Medicago arborea* contain, respectively, 17.5 and 16.2%, where as *Opuntia ficus indica* shows the lowest value (7.4%). The content of organic matter (OM) was comparable to *Atriplex halimus* and *Opuntia ficus indica* (74.3 and 70.4%) and statistically different compared to *Acacia cyanophylla* and *Medicago arborea* (91.8 and 91.4%). *Opuntia ficus indica* shows the lowest values in CBT, NDF, ADF and HC and inversely proportional presents the digestibility coefficient (CUD) the highest (77.8%). *Medicago arborea* has the highest values in CBT, NDF, ADF and HC CUD and the lowest. Four shrubs have studied energy values (UFL / kg DM) high and comparable to conventional concentrates. The amount of PDIN and PDIE (g / kg DM) is higher for *Atriplex halimus*, *Acacia cyanophylla* and *Medicago arborea*. Whereas *Opuntia ficus indica* displays the lowest amounts.

**Keywords:** Chemical composition, fodder shrubs, food value, plant cell wall

### 1. Introduction

In Tunisia, according to a recent survey, rangelands cover some 5.413000 ha distributed in forest and forest pasture (970.000 ha), *Stipa tenacissima*-based steppe (743.000 ha), communal and state rangelands (2.500 000 ha), and private rangelands (1.200 000 ha). National strategies for rangeland rehabilitation were initiated in most countries. The most important components of these strategies are plantations of shrubs. Planting fodder shrubs are undeniably an element of stability in the supply of small ruminants by deferring interannual forage accumulated 2 to 3 years and can be used in case of drought [1]. Planting fodder shrubs is a protective factor against wind erosion. Fodder shrubs increase the overall productivity of the biosphere screen function, nutrient recycling, maintenance and improvement of soil fertility and soil environments. These plantations, established first Were Mainly on communal lands goal more

and more recently, established were they mixed crop / livestock farms and private land. Planting shrubs are an investment in the medium and long term, a renewable resource, while prices and rates are the result of concentrated economic situations [2]. These arguments highlight the importance of forage shrubs that provide regular standing biomass throughout the year [3]. Are the main fodder shrubs *Atriplex* (*Atriplex halimus*), *Acacia* (*Acacia cyanophylla*), spineless cactus (*Opuntia ficus indica* var. *Inermis*) and *Medicago arborea*. *Opuntia* and shrubs are planted in wide rows allowing cereal cropping (mainly barley) in between. Animals may therefore graze the increased herbaceous biomass between the rows during spring, and stubbles during the summer time [4]. The seasonal supply of feed is then better adjusted to the animals' needs, and livestock feeding is based more on farm resources than on commercial feeds. Indeed livestock farmers, and especially small herd owners, face dramatic difficulties during the

frequent drought seasons. They are often forced to sell a large number of their flock in order to buy either rarely available expensive straw or hay or imported cereal-based feeds. Nutritionally, the above mentioned species complement each other. *Opuntia*, rich in water and carbohydrates, gives sufficient energy, *Atriplex* provides protein and *Acacia* is a fibre source [5].

## 2. Materials and Methods

### 2.1. Shrub species

Four tree species: *Atriplex halimus*, *Acacia cyanophylla*, *Medicago arborea* and *Opuntia ficus indica* were used. Samples the month of November has improved from a course belonging to the farm Sawaf- Zaghouan area north of Tunisia. The samples were dried at 40 ° C for 48 h did not affect the amount of tannins and their biological properties [6] and ground to a 2 mm sieve.

### 2.2. Measurements

Samples of different plant species were analyzed for their dry matter (DM), organic matter (OM), mineral content (MM), total nitrogenous matter (CP) and lipids (FAT) according to [7]. The total fiber (NDF) were obtained after dissolution under the action of a neutral detergent sodium content of Acid Detergent Fiber (ADF) was measured in the presence of cetyl tri methyl ammonium brome and lignin (ADL) was determined on the ADF residue subjected to the action of sulfuric acid solution at 72% [8].

The relationship between the levels of total plant walls (% DM) based on the total crude fiber (CF) are determined by reference to the table of [9].

$$\text{NDF} = 0.575 * \text{CF} + 32$$

$$\text{ADF} = 0.579 * \text{CF} + 14.7$$

$$\text{HC} = \text{NDF} - \text{ADF}$$

**Table1. Chemical composition of fodder shrubs (% DM)**

	DM	CP	MM	OM	FAT	ENA
<i>Atriplex halimus</i>	32.1	20.4 <sup>a</sup>	25.7 <sup>a</sup>	74.3 <sup>b</sup>	4.1 <sup>a</sup>	35.0
<i>Acacia cyanophylla</i>	63.1	17.5 <sup>b</sup>	8.2 <sup>b</sup>	91.8 <sup>a</sup>	3.0 <sup>a</sup>	47.0
<i>Medicago arborea</i>	51.9	16.2 <sup>b</sup>	8.6 <sup>b</sup>	91.4 <sup>a</sup>	3.0 <sup>a</sup>	39.7
<i>Opuntia ficus indica</i>	6.9	7.4 <sup>c</sup>	29.6 <sup>a</sup>	70.4 <sup>b</sup>	2.0 <sup>a</sup>	51.9

<sup>a,b,c</sup> : Means within a rows with no common superscripts differ significantly (P<.05).

Regarding the fiber content (Table 2), laboratory analysis reveals that the *Medicago arborea* has the highest levels in CF (32.5), NDF (50.7) and ADF

$$\text{FS} = 100 - \text{NDF}$$

The prediction of food values (UFL / kg DM PDIE g / kg DM and PDIN g / kg DM) according to the formulas of [10].

$$\text{UFL/kg DM} = [1.245 + 0.00248 * \text{CP} - 0.535 * 10^{-5} \text{CP}^2 - 0.001856 * \text{CF}] * \% \text{MO}$$

$$\text{PDIE g/kg DM} = \text{CP} * (1-\text{S}) * 0.65 * \text{dr} + 75.6 * \text{OMD}$$

$$\text{PDIN g/kg DM} = \text{CP} * (1-\text{S}) * 0.65 * \text{dr} + \text{CP} * (0.196 + 0.364 * \text{S})$$

Where S= 0.35; dr = 0.7

### 2.3. Statistical analyses

The results of the chemical composition, fiber content and nutritional values were subjected to analysis of variance according to the GLM procedure of [11] and compared by [12].

## 3. Results and Discussion

The chemical compositions of four shrubs samples are given in Table 1. *Atriplex halimus* has a high value in CP (20.4% DM) compared to other shrubs (p <0.05), whereas *Opuntia ficus indica* shows the lowest value. The results of these joined [1] who showed that these shrubs present values of CP comparable to raw materials such as faba bean and lupine. The content of fatty acids was statistically comparable for the four shrubs (p <0.05). These values are similar to the FAT content of the cereal grains. Mineral matter content was significantly higher (p <0.05) *Atriplex halimus* and *Opuntia ficus indica* and conversely the organic matter content is lower for these two shrubs with significant difference between the shrubs studied (p <0.05). This result is similar to what has been suggested by [13].

(33.5) compared to other shrubs (p <0.05), while *Opuntia ficus indica* displays the lowest values in different type of fiber (p <0.05). This difference reflects the difference in fiber digestibility of these shrubs (Table 3). Indeed, *Opuntia ficus indica*

shrub is the most digestible by ruminants (77.8%), *Medicago arborea* shrub is the least digestible, while *Atriplex halimus* and *Acacia cyanophylla*

occupies an intermediate position with respect to other.

**Table 2. Fiber content of different fodder shrubs (% DM)**

	CF	NDF	ADF	HC	FS
<i>Atriplex halimus</i>	14.8 <sup>c</sup>	40.5 <sup>b</sup>	23.3	17.2	59.5
<i>Acacia cyanophylla</i>	24.3 <sup>b</sup>	46.0 <sup>a</sup>	28.8	17.2	54.0
<i>Medicago arborea</i>	32.5 <sup>a</sup>	50.7 <sup>a</sup>	33.5	17.2	49.3
<i>Opuntia ficus indica</i>	9.1 <sup>d</sup>	37.2 <sup>b</sup>	20.0	17.2	62.8

<sup>a,b,c</sup> Means within a rows with no common superscripts differ significantly (P<.05).

The energy value of forage shrubs studied ranges from 0.78 to 0.94 UFL / kg DM (Table 3). This is consistent with the results of Chermiti and Nefzaoui (1991). *Acacia cyanophylla* presents the highest value which is comparable to that of feed concentrates. This can be explained by its nutritional value (CP 14 to 15% of CF and 25 to 30%) and a relatively high palatability especially after wilting, *Acacia cyanophylla* is undoubtedly a

promising species for the semi-arid Tunisia. However, its operating time (September to the end of winter) does not coincide with periods when its chemical composition and palatability are optimal (spring, summer). *Medicago arborea* has a lower energy value compared to other shrubs is what can be explained by its fiber content is higher. *Opuntia ficus indica* displays the lowest amounts in PDIN and PDIE it is related to its low CP.

**Table 3. Food value and digestibility of forage shrubs**

	UFL/kg DM	PDIE (g/kg DM)	PDIN (g/kg DM)	CUD
<i>Atriplex halimus</i>	0.86	98	148	67.3
<i>Acacia cyanophylla</i>	0.94	82	127	57.2
<i>Medicago arborea</i>	0.78	84	119	51.8
<i>Opuntia ficus indica</i>	0.84	63	54	77.8

PDIE: True protein absorbable in the small intestine when energy is limiting in the rumen; PDIN: True protein absorbable in the small intestine when N is limiting in the rumen; UFL: forage unit for lactation. CUD: Digestibility (%)

#### 4. Conclusion

In arid areas, rangelands are subject to different stresses, including drought and erosion. Given this situation, the major problem facing farming is the scarcity and irregularity of fodder resources. In this context, the use of fodder shrubs practice is required to ensure the independence and sustainability of our farm. For this, it is more interesting to use these shrubs mixed in the diet of ruminants for the complementarity of these shrubs. Indeed *Opuntia ficus indica* is rich in water, carbohydrates and vitamins. It is low in salts, protein and soluble salts. *Atriplex halimus* are rich in protein and low in soluble salts and water (especially in summer). Therefore, it is quite possible to think of mixed diets composed of one part salt (*Atriplex halimus*) unsalted energy part (cactus) and a protein portion unsalted (*Opuntia ficus indica*).

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