

# RESPONSES OF *ARTEMISIA HERBA-ALBA* ASSO. AND ITS ASSOCIATED SPECIES TO GRAZING FREQUENCY (MIDELT, MOROCCO).

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## ABSTRACT

The objective of this study (conducted in 1994) was to assess the effects of season and grazing frequency (control, continuous, intermittent during 2 days per week) on vegetation attributes, and animal feeding behavior. Mean standing crop, for which *Artemisia herba alba* contributed 72%, attained 533 for the control while it was maintained at 394 and 322 Kg DM/ha, for the continuous and the intermittent grazing, respectively. Mean productivity of *Artemisia herba alba* varied according to treatment and had values of 5.3, 3.0 and 2.5 Kg DM/ha/day, under the ungrazed control, the continuous and the intermittent grazing regimes, respectively. Percent utilization varied according to season, groups of plant species and treatment. Thus, this parameter ranged from 3.3% to 27.6%, and from 28% to 56.1%, for *Artemisia herba alba* and the perennial grasses, respectively. Mean contribution to sheep diets was similar (34%) for both *Artemisia herba alba* and the perennial grasses. However, it varied according to availability and the grazing regime. For example, *Artemisia herba alba* contributed with 27.1% and 41.7%, under the continuous and the intermittent grazing regimes, respectively.

## KEYWORDS

*Artemisia herba alba*, grazing regime, mean standing crop, productivity, contribution, relative preference

## INTRODUCTION

Developing a grazing management plan that is both ecologically and economically sound must take into account how the forage resource will respond to different levels, timing and duration of use. This grazing plan is dependent upon the combination of applying these principles. The *Artemisia herba-alba* dominated vegetation is an important rangeland resource in Morocco. The importance of this resource and the rate of its degradation have prompted a number of studies. Among these: the evaluation of the response of this low shrubland vegetation to different levels of stocking rates using a continuous grazing system (El Bare, 1985; Berkat, 1986; N'Grade, 1989), the biology of *Artemisia herba-alba* populations (Berkat 1986), the dynamics of its forage production (Benkhalifa, 1988; N'Grade, 1989), the impact of grazing on soils characteristics (El Bare, 1985; Berkat, 1986; Sabir, 1994), and animal performances (El Bare, 1985; Berkat, 1986). Although grazing management has been recognized to be critical in order to improve the management of these rangelands, only one investigation on the impact of grazing frequency on this type of vegetation has been carried out (El Haddi, 1993). This study is a contribution toward that end and has the objective of assessing the effect of grazing frequency (control, continuous, intermittent during 2 days per week) on vegetation parameters and on diet composition of sheep during winter, spring and summer seasons of 1994.

## METHODS

This investigation was conducted at the Sagebrush experimental area, located within the Aarid Perimeter in the High Moulouya Valley of Morocco (32° 64'N, 4° 95'W). Elevation is 1800 m. Soils are of brown calcareous type, of a silt-sandy texture, and of a depth not exceeding 30 cm (Berkat, 1986).

Climate is arid Mediterranean type with a cold winter. The rainy season extends from September to June with November and April

peaks. Mean annual precipitation is 225.7 mm. Mean annual temperature is 14.2°C. Monthly mean temperature ranges from 6.4°C in December to 24.1°C in July.

Vegetation is a low shrubland dominated by *Artemisia herba-alba* Asso. Other low shrub species include *Artemisia mesatlantica* L., *Teucrium polium* L., *Helianthemum croceum* (Desf.) Pers., *Helianthemum virgatum* (Desf.) Pers., *Thymus hirtus* L. and *Santolina rosmarinifolia* L. Dominant herbaceous species include *Dactylis glomerata* L., *Stipa barbata* Desf., *Stipa parviflora* Desf., *Kaeria vallesiana* (Honk.) Bert. and various annuals.

The experimental units consisted of 6 pastures allocated to 3 grazing treatments with 2 replications. Treatments were: control with no grazing, grazing every day (continuous), intermittent grazing during two days per week. Grazing was performed two hours per day with 81 ewes allocated to the pastures so as to obtain a moderate stocking rate of .75 ewe /ha (El Bare, 1985 and Berkat, 1986). Animals received each day 200 g of barley supplement.

Plant cover was determined using 3 permanent ten-meter lines per pasture with 10 cm reading intervals (Pieper, 1978; and Bonham, 1989).

Ten paired plots per treatment were used to evaluate vegetation parameters and utilization (Pieper, 1978). In each pair, one plot was protected by a cage of 2 m<sup>2</sup> (1m (2m)). Both quadrats were clipped every two weeks in order to determine consumable standing crop (from February to July), forage productivity for the April to July period, determined with the procedure described by Bonham (1989), percent utilization for the April to July period, determined from the difference between inside and outside cages as described by Pieper (1978). Sheep diets were determined every two weeks for the April to July period using the bite count method (Holechek *et al.*, 1982). For all these parameters, plant species were grouped into 5 categories: *Artemisia herba-alba* as a group and with its population components (adult vigorous, adult senescent, juveniles, seedlings), other shrubs, perennial grasses, other herbaceous perennials and annuals.

Data were subjected to analysis of variance to determine differences with regard to period and grazing treatment in a completely randomized block design with two replications. A 2 arcsin<sup>2</sup>% transformation was performed on percent data prior to analysis. Where appropriate, differences between means were separated using Newman - Keuls test at p<0.05 (Steel and Torrie, 1980).

## RESULTS AND DISCUSSION

Total plant cover varied from 21 to 42% with *Artemisia herba-alba* as the dominant plant species. The adult vigorous plants of this species were the dominant life state class within its population. *Artemisia herba-alba* mean cover attained 17.7% and was significantly affected by the grazing treatment only. El Bare (1985), Alaoui (1985) and El Haddi (1993) reported values at the same site, respectively of 12.2, 15.4 and 12.6. These differences could be explained by the climatic conditions and the grazing treatment. Cover of perennial grasses was significantly higher (p<0.05) under the control and intermittent grazing (7.1%) as compared to the continuous grazing (5.9%).

Consumable standing crop and in particular its *Artemisia* component increased from February to June for all treatments. This increase resulted from recruitment of a number of herbaceous plant species and from development of new shoots by the shrubby species. Consumable standing crop was significantly higher ( $p < 0.05$ ) under the control (533 Kg DM/ha) as compared to both grazing frequencies for which this parameter attained 322 and 394 Kg DM/ha, respectively for the intermittent and the continuous grazing regime (Table 1, a). *Artemisia herba-alba* contributed by 69% to the consumable standing crop and its production was significantly ( $p < 0.05$ ) affected by the grazing treatment (Table 1,  $\alpha$ ). The highest value was obtained under the control (361 Kg DM/ha), as compared to the treatments for which values of 216 and 280 Kg DM/ha were recorded for the intermittent and the continuous grazing, respectively (Table 1,  $\alpha$ ). Perennial grasses are the second most important group of species. Their contribution to the consumable standing crop varied from 11 to 14%. All the values obtained for this parameter were significantly different ( $p < 0.05$ ) and were 66, 46 and 35 Kg DM/ha, respectively for the control, the intermittent and the continuous grazing (Table 1,  $\alpha$ ). These values are twice those reported by El Haddi (1993). Even though the spring season was particularly dry, the productivity levels in April (for perennial grasses) and May (for *Artemisia herba-alba*) were high. This can be explained by the overall moisture regime. In fact, The 1993-94 year was wetter than usual especially in fall and winter. The grazing pressure did significantly affect the productivity of *Artemisia herba-alba* and the perennial grasses group (Table 1,  $\alpha$ ). The utilization and contribution of *Artemisia herba-alba* and perennial grasses to the sheep diets were significantly affected by the season and the grazing frequencies (Table 1,  $\alpha$ ). Perennial grasses were more utilized than *Artemisia* plants (Table 1,  $\alpha$ ), especially late in the season due to their higher palatability. The relative preference index (RPI) values obtained for this group of species were 1.8 and 2.0, respectively for the intermittent and the continuous grazing.

## REFERENCES

**Alaoui, M.** 1985. Contribution à l'étude de l'interface ovins-

végétation sous un système continu de pâturage : Effets du pâturage à différents niveaux de charge au printemps et en été sur les steppes à armoise blanche en Haute Moulouya. Mémoire de 3ème cycle en Agronomie. IAV Hassan II. Rabat.

**Benkhalifa, A.** 1988. Contribution à l'étude de la variabilité de la production de l'armoïse blanche à travers l'analyse des réponses des composantes démographiques à différents régimes pluviométriques. Mémoire de 3ème cycle, IAV Hassan II. Rabat.

**Berkat, O.** 1986. Population structure, dynamics and regeneration of *Artemisia herba-alba* Asso. Thèse de Doctorat Es-Sciences Agronomiques. IAV Hassan II. Rabat.

**Bonham, C.D.** 1989. Measurements for terrestrial vegetation. A cursery Interscience Publication. John Wiley and Sons, New York.

**El Bare, B.** 1985. Contribution à la connaissance des pâturages à armoïse: utilisation par les ovins et impacts du brouillage sous différents niveaux de charge. Mémoire d'assistanat, IAV Hassan II. Rabat.

**El Haddi, M.** 1993. Contribution à l'étude de l'impact de la fréquence de pâturage sur la steppe à armoïse blanche dans la Haute Moulouya (station expérimentale de l'Aarid). Mémoire de 3ème cycle en Agronomie, IAV Hassan II. Rabat.

**Holechek, J.L., M. Vavra, and R.D. Pieper.** 1982. Botanical composition determination of range herbivore diets: A review. J. Range. Manage. **35**:309-315.

**N'Grade, G.** 1989. Evolution saisonnière de la phytomasse et de la démographie des pousses de l'armoïse blanche (*Artemisia herba-alba* Asso) sous différents niveaux de charge. Mémoire de 3ème cycle, IAV Hassan II. Rabat.

**Pieper, R.D.** 1978. Measurement Techniques for Herbaceous and Shrubby Vegetation. New Mexico State University, Las Cruces, N. Mex.

**Sabir, M.** 1994. Impact du pâturage sur l'état de surface et les propriétés hydrologiques d'un sol dans un milieu steppique marocain (Périmètre de l'Aarid, Haute Moulouya) .Thèse de Doctorat Es-Sciences Agronomiques. IAV Hassan II. Rabat.

**Steel, R.G.D., and J.H. Torrie.** 1980. Principles and procedures of statistics. Second edition. McGraw-Hill Book Co., N.Y. 632pp.

**Table 1**

Residual phytomass<sup>a</sup>(Kg DM ha<sup>-1</sup>), productivity<sup>b</sup>(Kg DM ha<sup>-1</sup>day<sup>-1</sup>), utilization<sup>c</sup>(%) and contribution<sup>d</sup>(%)of different group of species to sheep diets during the periods of 2/28 to 7/4/94 at the Aarid experimental station (Midelt, Morocco) for the grazing treatments (Continuous, intermittent and ungrazed control).

$\alpha$						
Group of species	<i>Artemisia herba-alba</i>	Perennial grasses	Other shrubs	Perennial forbs	Annuals	Total
Intermittent	216b <sup>1</sup>	35c	18b	32b	21a	322c
Continuous	280c	46b	27b	27b	13a	394b
Control	361a	66a	38a	45a	21a	533a
$\beta$						
Group of species	<i>Artemisia herba-alba</i>	Perennial grasses	Other shrubs	Perennial forbs	Annuals	Total
Intermittent	2.5c <sup>1</sup>	1.2a	0.3a	0.8a	0.7a	5.3b
Continuous	3.0b	1.2a	0.4a	0.8a	0.4a	5.9b
Control	5.3a	0.5b	0.3a	0.7a	0.4a	7.3a
$\chi$						
Group of species	<i>Artemisia herba-alba</i>	Perennial grasses	Other shrubs	Perennial forbs	Annuals	Total
Intermittent	12.3a <sup>1</sup>	36.8a	2.8b	17.2a	22.4a	17.9a
Continuous	9.1b	31.5b	4.8a	20.6a	17.9a	14.5b
$\delta$						
Group of species	<i>Artemisia herba-alba</i>	Perennial grasses	Other shrubs	Perennial forbs	Annuals	Total
Intermittent	41.7a <sup>1</sup>	30.3b	6.9a	17.2b	3.9a	
Continuous	27.1b	38.0a	7.0a	25.5a	2.3b	

<sup>1</sup> Means in a column not sharing a common letter differ significantly (P ( 0.05)