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Abstract. The effect of season on pasture botanical and chemical compositions, herbage biomass, organic matter intake by ewes and nutrient digestibility coefficients were investigated in the region of Sedrata (south-east of Algeria). The botanical composition and the herbage biomass were determined using the transect method in spring (last two weeks of March) and summer (last two weeks of June). Simultaneously, dry matter intake (DMI) and digestibility coefficients of organic matter (OM), crude protein (CP) and neutral detergent fibre (NDF) of pasture herbage were evaluated using 5 Ouled Djellal breed ewes. Acid insoluble ash (AIA) as an internal marker in faeces and in pasture biomass was used to estimate digestibility and therefore intake. The experiment was repeated through two consecutive years (2001-2002). The legume proportion was higher ($P < 0.01$) in spring than in summer (21 and 11% of DM respectively). The same trend was observed for grass proportion (67 and 57% respectively). The crude protein content of the herbage decreased ($P < 0.001$) from spring to summer (15 and 9.4% of DM respectively). Total cell wall content (NDF) was higher ($P < 0.001$) in summer than in spring (62.7 and 53.7% of DM respectively). The DM intake by ewes decreased significantly ($P < 0.001$) as the grazing season advanced (1268 and 1085 g DM/day in spring and in summer, respectively). The same trend was observed for OM, CP and NDF digestibility coefficients ($P < 0.001$). It was concluded that in the studied region, pasture was of a higher feeding value in spring than in summer.

Keywords. Seasonal variations – Pasture – Chemical composition – Digestibility – Intake – Ewes – AIA.

Variations saisonnières de la composition chimique, de l'ingestion et de la digestibilité chez les brebis placées sur parcours naturels dans les régions Sud-Est d'Algérie

Résumé. *Dans une région du sud-est de l'Algérie (Sedrata), nous avons étudié les effets de l'année et de la saison sur la composition botanique et chimique du pâturage, l'ingestion volontaire et la digestibilité. La biomasse et la composition botanique sont déterminées à l'aide de quadrats récoltés le long de transects au printemps (fin mars) et en été (fin juin). Parallèlement nous avons évalué l'ingestion de la matière sèche (MSI), la digestibilité de la matière organique (DMO), des matières azotée totales (DMAT) et de la paroi totale (Neutral Detergent Fibre : NDF) du pâturage. Pour cet essai nous avons utilisé cinq brebis de la race Ouled-Djellal équipées de harnais pour la collecte des fèces. Les cendres insolubles dans l'acide chlorhydrique (AIA : Acid Insoluble Ash), dosés dans l'herbe et les fèces sont utilisées comme marqueur interne pour estimer la digestibilité et ensuite l'ingestion. L'essai est effectué durant deux années consécutives (2000-2001). Le taux de légumineuses est plus élevé au printemps (21* vs *11%). La même tendance est observée pour le taux de graminées (67* vs *57%, respectivement). L'apport de MAT du pâturage diminue entre le printemps et l'été (15* vs *9.4%). La teneur en paroi totale (NDF) est élevée en été et basse au printemps (62.7* vs *53.7%). L'ingestion des brebis diminue avec l'avancement de la saison (1268* vs *1085 g/brebis/jour, respectivement pour le printemps et l'été). La même tendance est observée dans les coefficients de DMO, de DMAT et de NDF. Il est à conclure que dans la région étudiée, les apports alimentaires du pâturage ont une meilleure valeur alimentaire au printemps qu'en été.*

Mots-clés. *Variations saisonnières – Pâturage – Composition chimique – Digestibilité – Ingestion – Brebis – AIA.*

I – Introduction

In the south eastern Algeria, pastures provide green high quality herbage for grazing animals only from February to May. During the dry period barley and wheat bran are often used to supplement ewes. Factors such as the botanical composition of the pasture and the stage of maturity may influence the feeding value of the consumed biomass. Neither the pasture quality, nor the effect of supplementation on diets feeding value or animal performances have been studied yet studied in the region of Algeria. The main difficulty to evaluate pasture feeding value for grazing ruminants is the estimating of herbage intake and digestibility. In this view, the use of internal markers such as acid insoluble ash (AIA) has been suggested in sheep (van Keulen and Young, 1977), in steers (Sunvold and Cochran, 1991), and in horse (Bergero *et al*., 2004). The aim of the present study was to evaluate the effects of season and year on herbage chemical and botanical composition, intake and digestibility of grazing ewes in the south eastern pastoral area of Algeria.

II – Materials and methods

The experiments were carried out in the region of Sedrata (south-east of Algeria). The site has a Mediterranean climate with mean minimum and maximum temperatures of 0.3 and 13°C, respectively in winter. The summer is dry and hot, with mean minimum and maximum temperatures of 14 and 38°C, respectively. The average annual rainfall is 450 mm, falling mostly in winter.

Five dry Ouled-Djellal-breed ewes (mean age: 4 years; mean body metabolic weight: 14.8 $kg^{0.75}$) has been used for total faecal collection and therefore to evaluate nutrient intake and digestibility.

The botanical composition and the herbage biomass were determined using quadrates and transect method in spring (last two weeks of March) and summer (last two weeks of June). Simultaneously, DMI, OMD, CPD and NDFD of pasture herbage were evaluated. During each measurement periods, herbage was collected in triplicates on nine quadrates, along transect in the pasture area every two weeks. In each quadrates, the herbage was cut at 6 cm sward height. Samples were mixed together for each plot and separated into grass, legumes and others species. Acid insoluble ash (AIA) as an internal marker in faeces and in grazed pasture was used to estimate digestibility and therefore intake (van Keulen and Young, 1977). The experiment was repeated through two consecutive years (2001-2002).

Biomass and faeces samples were analyzed for ash, OM and CP using standard methods of AOAC (1990). Cell wall components (NDF, ADF and ADL) were analysed as described by Goering and van Soest (1970). Acid insoluble ash was determined using the procedure outlined by van Keulen and Young (1977).

The effects of season and year on herbage botanical and chemical composition, on nutrients intake and digestibility (year, season, season × year) were analysed using the ANOVA procedure of SAS (2007). Duncan multiple range test, was used to compare treatment means.

III – Results

Pasture yield (Table 1) was significantly different ($P < 0.001$) between years and seasons (1399 and 1293 kg/ha in 2000 and 2001 respectively; 1532 and 1160 kg/ha in spring and summer respectively). The season comparison showed higher proportion in spring for grass and legume species. Grass species are the dominant ($P < 0.001$) during the two seasons (67 and 57% of DM respectively in spring and summer). Legumes proportion was higher ($P < 0.01$) in spring than in summer (21 *vs* 11% of DM, respectively), and the proportion of others species was higher (P < 0001) in summer than in spring (32 *vs* 10%, respectively).

Forage CP content was higher ($P < 0.001$) in spring (15% of DM) than in summer (9.4% of DM). All the cell wall components were higher in summer than in spring (Table 2, $P < 0.001$). Year effect on chemical composition was significant. In deed, CP content was higher (P < 0.001) in 2000 (13.3% of DM) than in 2001 (11.2% of DM); while all the cell wall components were higher in 2001 than in 2000 (Table 2, P < 0.001).

Table 1. Effects of season and year on pasture yield (DM kg/ha) and botanical composition (% of DM)

Biomass	Year				Season			
	1(2000)	2(2001)	SEM†	P	Spring (1, 2)	Summer (1, 2)	SEM	P
DM (kg)	1399[a]	1293[b]	22	**	1532[a]	1160[b]	23	**
% grass	62[a]	61[a]	2.4	ns	67[a]	57[b]	0.6	**
% legumes	17[a]	16[a]	1	ns	21[a]	11[b]	0.6	**
% others	20[a]	22[b]	1.98	**	10[a]	32[b]	0.7	**

**P < 0.05, SEM: Standard error of the mean, ns: not significant (P > 0.05).
[a,b]For the same line, values with the same letter do not differ significantly (P > 0.05).

Table 2. Effects of season and year on biomass botanical and chemical composition

	Year				Season			
	1(2000)	2(2001)	SEM†	P	Spring (1, 2)	Summer (1, 2)	SEM†	P
OM/kg MS	952[a]	948[a]	2.8	ns	965[a]	933[b]	1.5	**
Ash/kg MS	4.8[a]	5.2[a]	2.8	ns	3.4[a]	6.7[b]	1.5	**
CP (%)	13.3[a]	11.2[b]	0.56	**	15.0[a]	9.4[b]	1.8	**
NDF (%)	56.3[a]	60.1[b]	13.5	**	53.7[a]	62.7[b]	4.2	**
ADF (%)	33.1[a]	36.5[b]	9.3	**	31.7[a]	38[b]	3.2	**
ADL (%)	6.5[a]	8.7[b]	4.7	**	5.3[a]	10[b]	1.5	**

**P < 0.01, SEM: Standard error of the mean, ns: not significant.
[a,b]For the same line, values with the same letter do not differ significantly.

Intake (Table 3) was significantly (P < 0.001) higher in 2001 (1120 *vs* 1233 g/day, respectively in 2000 and 2001) and was higher (P < 0.001) in spring than in summer (1268 *vs* 1085 g/day, respectively). There was a significant difference (P < 0.01) between years for CP intake (135 and 129 g/day, respectively for 2000 and 2001). As grazing season advanced, CP intake decreased (P < 0.001) from spring to summer (175 *vs* 86 g/day, respectively). There was significant (P < 0.001) difference between years in DM, CP and ADF digestibility coefficients. The DM, CP and ADF digestibility coefficients in spring (0.71, 0.73 and 0.54, respectively) were higher (P < 0.001) comparatively with summer (0.52, 0.54 and 0.36, respectively).

The feeding value as expressed by digestible intake is presented in Table 4. Digestible OM intake was not significantly different between the two years. However, DCPI was significantly higher (P < 0.02) in 2000 than in 2001 (6 and 5.4 g/kg$^{0.75}$/day, respectively). Season comparison revealed higher (P < 0.001) DOMI values in spring than in summer (59.6 and 35.8 g/kg$^{0.75}$/day respectively) and the same trend for DCPI (8.6 and 3.1 g/kg$^{0.75}$/day, respectively).

IV – Discussion

There is general agreement that the quality of herbage, expressed as digestibility (Minson, 1990), CP level, structural carbohydrates content (Mertens, 1987; van Soest, 1994) or "filling value"

(Jarrige *et al*., 1986), could influence forage intake. In the current study, differences between years were attributed to climate conditions. Animut *et al*. (2005) suggested that herbage biomass above 1000 kg/ha do not limit the intake of grazing sheep. In our case biomass was not a limiting factor for intake.

Table 3. Effects of season and year on intake and digestion of forage constituents

	Year				Season			
	1(2000)	2(2001)	SEM†	P	Spring (1, 2)	Summer (1, 2)	SEM†	P
Intake (g)								
DMI	1120[a]	1233[b]	54	**	1268[a]	1085[b]	44	**
OMI	1066[a]	1182[b]	52	**	1227[a]	1021[b]	42	**
CPI	135[a]	129[a]	7	ns	175[a]	86[b]	5.7	**
Digestibility								
DOM	0.64[a]	0.60[b]	0.098	**	0.72[a]	0.52[b]	0.008	**
CPD	0.66[a]	0.62[b]	0.008	**	0.73[a]	0.54[b]	0.006	**
ADFD	0.47[a]	0.44[a]	0.008	**	0.54[a]	0.36[b]	0.007	**

**P < 0.01, SEM: Standard error of the mean, ns: not significant.
[a,b]For the same line, values with the same letter do not differ significantly.

Table 4. Feeding value as digestible intake (g/ewe/day)

	Year				Season			
	1(2000)	2(2001)	P	SEM†	Spring (1, 2)	Summer (1, 2)	P	SEM†
DOM intake	682[a]	709[a]	ns	34	883[a]	530[b]	**	28
CP intake	89[a]	80[b]	*	4.8	127.7[a]	46.4[b]	**	3.9

*P < 0.05, **P < 0.01, SEM: Standard error of the mean, ns: not significant.
[a,b]For the same line, values with the same letter do not differ significantly.

The NDF content was lower and the CP content was higher in spring, comparatively to summer. The same trend of variation was observed for dry matter and CP intake, witch decreased as grazing season advanced from spring to summer. This is in line with results of García *et al*. (1995), Ramírez *et al*. (2002) and Aharoni *et al*. (2004). Aharoni *et al*. (2004) noted that DM intake and digestible dry matter increased with CP content of the herbage. Avondo *et al*. (2002) suggested that a pasture constrains potential ingestion when the CP content is below 16% of DM and the biomass availability varies between 2500 and 3000 kg DM/ha, or when the CP level of the herbage is lower and the biomass availability was lower than 1000 kg DM/ha. Furthermore, Alderman (1987) suggested that 160 to 170 g CP/kg DM in forage is required to meat rumen microbial N needs. This is consistent with our results and CP herbage content in spring could explain the higher dry matter intake and better dietary DM digestibility in this season. In contrast the lower CP content in summer could explain the lower dry matter intake and digestibility.

The DOMI found in spring (883 g/day) reached the level of 730 g/day, suggested as the maintenance energy needs for ewes (Tissier and Theriez, 1978). However, these energy requirements are not satisfied in summer (DOMI: 530 g/day).

V – Conclusions

It was concluded that in the studied region, pasture varied with the year in relation to the rainfall. A higher feeding value of herbage is available in spring. In summer energy supply of biomass seemed to be below the maintenance requirements of ewes. However in this study, the number of monitored sheep and their physiological state could limit the relevance of our results. Consequently the current measurements should be extended on higher number of animals and during longer periods including all physiological stages.

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