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Abstract. The paper aims to analyse botanical composition, DM (dry matter) yield and chemical composition of lowland grasslands to evaluate their effect on growth performances of lambs of three breeds (Bergamasca, Sopravissana and Merinizzata) in Marche region. An experimental flock (lambs and ewes of all monitored breeds) grazed four plots differing in site conditions, management and forage characteristics. In each plot, the following grassland characteristics were assessed: botanical composition (at the beginning of grazing), forage DM yield and chemical composition (at the beginning and at the end). To calculate average daily gain (ADG), lambs of each breed were weighed at birth and every 20 days until the slaughter, performed at 60 days of age. Plot 1 was dominated by grasses (mainly, *Lolium multiflorum*), plots 2 and 3 by legumes (mainly, *Medicago sativa*), while plot 4 was mainly dominated by forbs (among all, *Veronica hederifolia*). The comparison of DM yield and chemical composition at the beginning and at the end of the grazing period within each plot revealed significant differences regarding some of the parameters. No statistical differences in live weight and ADG were observed among breeds. ADG during the whole period amounted to 323, 324 and 234 g d^{-1} for Bergamasca, Sopravissana and Merinizzata, respectively.

Keywords. Forage yield – Forage quality – Lamb performance – Average daily gain.

Caractéristiques des prairies de plaine utilisées dans les systèmes de moutons transhumants de la région des Marches (Italie centrale)

Résumé. *Ce travail vise à analyser la production et la composition chimique et botanique des prairies de plaine pour l'évaluation de leur effet sur les performances d'agneaux de trois races (Bergamasca, Sopravissana et Merinizzata) dans la région des Marches. Le troupeau expérimental (brebis et agneaux) a utilisé quatre parcelles différentes en termes de conditions de site, gestion et caractéristiques fourragères. Dans chaque parcelle, la composition botanique a été évaluée en début de pâturage, tandis que la production de fourrages et la composition chimique l'étaient au début et à la fin. Pour calculer le gain moyen quotidien (GMQ), les agneaux de chaque race ont été pondérés à la naissance et tous les 20 jours jusqu'à l'abattage, effectué à 60 jours d'âge. Le terrain 1 a été dominé par des graminées (principalement, Lolium multiflorum), les terrains 2 et 3 par les légumineuses (principalement, Medicago sativa), tandis que le terrain 4 a été principalement dominé par diverses autres plantes herbacées (entre elles, Veronica hederifolia). La comparaison de la production et de la composition chimique au début et à la fin de la période de pâturage à l'intérieur de chaque parcelle a montré des différences significatives pour certains des paramètres. Aucune différence statistique du poids vif et du GMQ n'a été observée parmi les races. Les GMQ durant toute la période étaient de 323, 324 et 234 g j^{-1} pour Bergamasca, Sopravissana et Merinizzata, respectivement.*

Mots-clés. *Production fourragère – Qualité du fourrage – Performances comparées des agneaux - Gain moyen quotidien.*

I – Introduction

In Central Italy, lamb production is mainly based on extensive grazing systems (Caballero *et al.*, 2009). Most of the flocks (up to 4000-5000 sheep) graze different grazing blocks throughout the year. During summer time, they use upland pastures and in autumn-winter period sheep are progressively transferred to lowlands. In Marche region itinerant and vertical grazing, continuous stocking and permanent shepherding are common. Lucerne meadows are the main

resource used, but the forage balance can include green cereals, crop residues, marginal lands and riverbanks itinerantly grazed (D'Ottavio and Santilocchi, 2014).

Taking the characteristics of the system into account, the study aims to analyse the botanical composition, forage yield and quality of lowland grasslands to evaluate their effect on growth performances of lambs of three breeds (Bergamasca, Sopravissana and Merinizzata) produced for Easter market under the PGI label "Agnello del Centro Italia".

II – Materials and methods

The study was carried out on four plots located at the surrounding of Macerata characterised by clay soils with different morphology, slope and altitude (150-300 m a.s.l.). The climate of the studied area is characterised by mean annual temperature of 13.7°C and mean annual precipitation of 792 mm. The plots were progressively grazed by an experimental flock (ewes and lambs of all the monitored breeds) from mid-February to mid-April 2015. Botanical composition of the grasslands was assessed before grazing, employing the abundance-dominance method by 3 surveys per each plot. Dry matter (DM) yield was estimated on three 1.0 m^2-sampling areas (1.0x1.0 m), randomly chosen on each plot at the beginning and at the end of grazing (Frame, 1981). Pre- and post-grazing herbage samples were dried at 60°C for 48 h and separately analysed to determine: Crude Protein (CP, Kjeldahl method), Ether extract (EE), Crude Fibre (CF, Weende method), NDF (Neutral Detergent Fibre), ADF (Acid Detergent Fibre), ADL (Acid Detergent Lignin) (Van Soest method, according to Martillotti *et al*., 1987) and Ash. Net Energy for Lactation (NEL) of the herbage samples was assessed according to I.N.R.A. (1980).

Total of 11 male lambs (born as singles) per each breed (Bergamasca, Sopravissana and Merinizzata) was used to assess the growth performances. At birth, all the lambs were weighed and gathered with their mothers into an experimental flock. Individual lamb weights were recorded each 20 days until the slaughter and average daily gain was calculated. Dams had free access to hay and were supplemented by corn grain (0.5 kg DM $head^{-1}$ day^{-1}); lambs were given concentrate (50% corn, 50% barley) *ad libitum* in creep feeders from 20 days of age.

The data analysis was performed by SAS/Studio® software (version 3.4, SAS Institute, Cary, NC, USA). Within each plot, means comparison of DM yield and chemical composition between the beginning and the end of the grazing periods was performed by using t test. The effect of breed on live weight and average daily gain (ADG) was analysed by means of one-way analysis of variance using the GLM procedure.

III – Results and discussion

During 60 days, from mid-February, flock was moved to four different plots for grazing periods which length depended on the forage availability and quality.

1. Botanical composition, DM yield and chemical composition of the grasslands

The used grasslands differ in terms of site conditions, management and forage characteristics (Table 1). In Plot 1-3 they were meadows dominated by different species: in plot 1 by grasses (mainly, *Lolium multiflorum*), while in plots 2 and 3 by legumes (mainly, *Medicago sativa*). Plot 4, a post-harvested field used for a short period just before the sowing of corn, was mainly dominated by forbs (among all, *Veronica hederifolia*).

DM yield of the samples harvested in the plots (Table 2) is comparable with those reported in relevant literature (e.g. Stavarache *et al*., 2015) and can be attributed to the late winter (plots 1 and 2) or early spring (plot 3) utilisation. The chemical composition of the forage (Table 2) is in accordance with the relevant literature. In particular, the high CP content in plots 2 and 3 (18.8

and 28.1%, respectively) is in accordance with Popovic *et al.* (2001) and can be explained by a high contribution of legumes (81.7 and 87.3%, respectively) at early stages of growth. The levels of CF and fiber fractions reflect the botanical composition of the grasslands and the vegetative stage of the dominant species. Higher values of ash, in particular in plots 2 and 3 (26.1 and 23.1%, respectively), are probably due to high soil pollution of the forage samples caused by rainfall and trampling that occurred at the end of the grazing period. The calculated values of NEL are in line with the forage quality and its good nutritional characteristics

Table 1. Characteristics and botanical composition of the grasslands in the grazed plots (mean % abundance of the most abundant species)

Plot	1	2	3	4
Altitude (m a.s.l.)	190	234	300	148
Exposure	NW	E	NW	S
Slope (%)	1	8	65	1
Grazing beginning (date)	17/2	27/2	18/3	30/3
Vegetation cover (%)	100	97	97	96
Grasses % abundance	71.9	17.1	2.9	12.8
Legumes % abundance	27.5	81.7	87.3	0.0
Forbs % abundance	0.6	1.2	9.9	87.2
Trifolium pratense L.	3.1			
Medicago sativa L.	24.4	80.6	87.3	
Lolium multiflorum Lam.	71.3	15.1	2.1	12.8
Veronica agrestis L.	0.2		8.2	
Fumaria officinalis L.			0.2	7.8
Diplotaxis erucoides (L.) DC.			0.2	3.1
Veronica hederifolia L.				52.6
Senecio vulgaris L.				14.1
Other species	1.0	4.2	2.1	9.6

Table 2. DM yield (t ha^{-1}), chemical composition (% DM) and NEL (MJ kg^{-1} DM) of the plots grasslands at the beginning (B) and at the end (E) of the grazing period

Plot	Grazing period	DM yield	% CP	% EE	% CF	% NDF	% ADF	% ADL	% Ash	NEL
1	B (17/2)	2.69^{A}	13.65	1.88	18.10^{b}	38.16^{b}	28.57^{b}	5.49	15.13	8.08^{a}
	E (27/2)	1.23^{B}	13.74	1.73	21.35^{a}	43.35^{a}	31.42^{a}	6.64	13.44	7.44^{b}
2	B (27/2)	2.88	18.85	1.23	28.31^{a}	48.26^{a}	40.99^{a}	11.10^{a}	14.76	6.09^{b}
	E (18/3)	1.63	20.03	1.37	18.39^{b}	34.68^{b}	30.82^{b}	6.96^{b}	26.15	7.92^{a}
3	B (18/3)	3.51	28.11^{a}	1.81	17.32	33.99	26.25	6.86	12.41	8.28
	E (30/3)	1.73	22.51^{b}	1.28	14.77	29.29	25.88	5.73	23.07	8.68
4	B (30/3)	4.16	10.92	1.91	24.78	47.13	37.71	6.91	15.84	6.74
	E (14/4)	3.84	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a

Within the plots, superscript letters indicate significant differences: A, B ($p<0.01$), a, b ($p<0.05$); n/a: not assessed.

The comparison of the forage yield and quality at the beginning and at the end of the grazing period within each plot showed significant differences ($P<0.01$) for DM yield (plot 1) and at $P<0.05$ level for CP (plot 3), CF, NDF and ADF (plot 1 and 1), ADL (plot 2) and NEL (plot 1 and 2). As expected, forage DM yield was reduced at the end of grazing of each plot, even though it significantly ($P<0.01$) decreased just for the plot 1 (-54%). Within plot 3, a significant decrease of the CP content was recorded at end of the grazing period, indicating that animals consumed components with higher CP content. In terms of CF and fiber fractions, statistical analysis

showed significant differences according to expectation only in the plot 1 where CF, NDF and ADF increased as a result of grazing. The opposing results observed in plot 2 seem to be attributed to vegetative regrowth that occurred at the end of the winter. As expected, NEL is lower after grazing in plot 1, while opposing results were recorded in plot 2 (significant increase) and plot 3, due to lower fiber content at the end of the grazing period.

2. Growth performances of the lambs

Birth and final live weight (LW), as well as average daily gain (ADG) of the lambs of the three breeds are presented in Table 3. No differences in lambs LW and ADG were observed among breeds, although ADG tended to be greater for Merinizzata during the last 20 days of growing period.

Lambs of all the breeds had higher birth weight, as well as LW and ADG than those reported to be the standard breed characteristics by ASSONAPA (2015).

Table 3. Growth performances of Bergamasca, Sopravissana and Merinizzata lambs

	Bergamasca	Sopravissana	Merinizzata	SEM	P
Live Weight (kg)					
Birth	6.30	5.90	5.50	0.18	0.1939
20 days	13.32	12.70	11.80	0.37	0.2689
40 days	19.47	18.55	16.91	0.61	0.2279
60 days	26.07	25.22	24.71	0.71	0.7508
Average Daily Gain (g d^{-1})					
0-20 days	336	366	345	13.06	0.6523
20-40 days	293	292	255	14.76	0.5025
40-60 days	314	318	371	12.34	0.0977
0-60 days	323	324	324	10.36	0.9997

SEM: standard error of the mean; P: probability of the differences.

IV – Conclusions

The present study demonstrates that the system adopted in Marche region, in which the most diverse grasslands, in terms of botanical composition and availability of high quality forage, are used, allowing the production of the lambs of different breeds with high growth performances.

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