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SUMMARY – Two experiments were conducted (E1) and (E2) with multiparous Lacaune dairy ewes in late lactating stage. The ewes were fed only pasture (cocksfoot E1, Italian ray grass E2) without supplementation except in E1 (+200 g dehydrated alfalfa/d/e). Pasture was available for about 6 hours, in daytime between the 2 milkings. During the time left, they were kept indoors with water and a salt block. In E1, 3 groups of 16 ewes divided on body weight (BW: 70 ± 6kg) body condition score (BCS: 3.2± 0.3) and milk yield (MY: 0.9 ± 0.2l/d) basis were offered one of the three different herbage allowances (namely L1, M1 and H1): low (1.4), medium (1.9) and high (2.4 kg DM/d/ewe) respectively. Each group was strip grazed for 3 weeks. In E2, 2 groups of 24 ewes were divided on the same criteria: (BW: 70±6kg), (BCS: 3.2±0.2) and (MY: 1.0± 0.3 l/d) were offered one of the 2 herbage allowances (namely L2 and M2): low (1.4) or medium (1.9 kg DM/d/ewe) respectively. In both experiments, 4 (E1) or 8 (E2) ewes per group were daily dosed with Ytterbium oxide as faecal marker. In E1, DM intake of ewes in L1, M1 and H1 was 1.3 ±0.3, 1.7±0.3 and 1.7±0.2 kg/d respectively. There were no differences (P>0.05) in BW (67.1±6.5 kg), BCS (3.0±0.2), milk yield (0.7±0.2 l/d), milk fat (MF 86±10 g/l) and milk protein (MP 60± 6 g/l) contents. In E2, due to a severe dry season, the experiment was shortened (less than 2 weeks). Herbage allowance was maintained by means of increasing paddock area. Nevertheless, daily DM intake of B2 and M2 groups was dramatically low: 0.49±0.12 and 0.68±0.12 kg respectively. There were no differences (P>0.05) in BW (64.6±5.3 kg), BCS (2.9±0.2), milk yield (0.9±0.2 l/d), MF (93±9 g/l) and MP (56±4 g/l) contents. In conclusion, dairy ewes intake did not exceed 1.7 kg DM/d at pasture when milk yield was low (end of lactation) and with only 6 hours grazing. When grass is offered at a low level, and when intake is very low, the ewes still maintain the milk yield (on a short time) but probably part of their energy requirements is mobilised from the body reserves. Experiments should be carried out at an earlier stage of lactation in order to reveal a more pronounced effect of herbage allowance at pasture.

Keywords: *Pasture, dairy ewe, intake, milk production.*

RESUME – *"Effet du pâturage comme unique aliment et de la ration d'herbage sur l'ingestion volontaire de brebis laitières". Deux essais (E1) et (E2) ont été conduits avec des brebis laitières multipares de race Lacaune en fin de lactation. Les animaux n'avaient que du pâturage (dactyle E1, ray-grass italien E2) comme alimentation, excepté pour E1 où ils recevaient en plus 200 g de bouchons de luzerne déshydratée par jour. Les animaux avaient accès au pâturage entre la traite du matin et celle du soir soit environ 6 h/j. Le reste du temps les brebis étaient maintenues en bergerie où elles avaient librement accès à l'eau et à une pierre de sel. Dans l'essai E1, 3 lots (L1, M1 et H1) de 16 brebis équilibrés sur le poids vif (BW: 70±6 kg) l'état corporel (BCS: 3,2±0,3) et la production laitière (MY: 0,9±0,2l/j) pâturaient une surface différente afin de leur fournir respectivement une quantité d'herbe : basse (1,4), moyenne (1,9) et haute (2,4 kg DM/j/anim.) Une nouvelle surface délimitée par une clôture électrique, était offerte chaque jour pendant 3 semaines. Dans l'essai E2, 2 lots (L2 et M2) de 24 brebis équilibrés sur le poids vif (BW: 70±6kg), l'état corporel (BCS: 3,2± 0,2) et la production laitière (MY: 1,0±0,3 l/j) pâturaient une surface différente afin de leur fournir respectivement une quantité d'herbe : basse (1,4) et moyenne (1,9 kg DM/j/anim). Dans les 2 essais, 4 (E1) ou 8 (E2) brebis par lot étaient droguées quotidiennement 2 fois par jour avec de l'oxyde d'ytterbium comme marqueur fécal pour déterminer les quantités ingérées individuelles. Dans l'essai E1, la DM ingérée des lots L1, M1 et H1 était respectivement de 1,3 ±0,3, 1,7±0,3 et 1,7±0,2 kg/j. Aucune différence significative (P>0.05) n'a été observée entre les lots pour le poids vif (67,1± 6,5 kg), l'état corporel (3,0±0,2), la production laitière (0,7±0,2 l/j), et les taux butyreux (MF 86± 10g/l) et protéique (MP 60± 6 g/l). Du fait d'une sécheresse sévère, l'essai E2 a dû être interrompu avant la 3ème semaine. Malgré un accroissement des surfaces, les quantités d'herbe offertes ont été difficilement maintenues. Dès lors, les quantités ingérées mesurées ont été très faibles pour les lots B2 et M2 avec respectivement : 0,49±0,12 et 0,68±0,12 kg DM. Aucune différence significative (P>0.05) n'a été observée entre les lots pour le poids vif (64,6±5,3 kg), l'état corporel (2,9±0,2), la production laitière (0,9±0,2 l/j), et les taux butyreux (MF 93±9 g/l) et protéique (MP 56±4 g/l). En conclusion, les quantités ingérées de brebis laitières en fin de lactation conduites au pâturage n'excèdent pas 1,7 kg/j de DM. Lorsque les quantités d'herbe offerte sont faibles, les brebis semblent maintenir un niveau de production modéré, mais probablement au détriment de leurs réserves corporelles. Afin*

de mieux caractériser l'effet d'une alimentation au pâturage sur la production laitière, il faudrait l'étudier à un stade de lactation plus précoce.

Mots-clés : *Pâturage, brebis laitière, quantité ingérée, production de lait.*

Introduction

In France, milk production from dairy sheep is organized on winter lambings and based on preserved forages and concentrates. Pasture period occurs in the second part of the lactation. During the indoor period, ewe's feeding is relatively well known (Fraysse *et al*., 1996; Bocquier and Caja, 1999, 2001; Bocquier *et al*., 2002), while information are lacking at pasture (Avondo *et al*., 1995; Ligios *et al*., 2002; Molle *et al*., 2002; 2003). Consequently, we attempted to measure in a first time, the voluntary intake of dairy ewes at pasture under common practice in the milking system which allow animal to graze in daylight between the two milking (morning and late afternoon).

Material and methods

Two experiments were conducted (E1) and (E2) with multiparous Lacaune dairy ewes in late lactating stage. The ewes were fed only pasture (cocksfoot E1, Italian Ray grass E2) without supplement excepted in E1 (+200 g dehydrated alfalfa/d/ewe). Pasture was available for about 6 hours, in daytime between the 2 milking. The time left, they were kept indoor with water and salt block. In E1, 3 groups of 16 ewes balanced on body weight (BW: 70±6 kg), body condition score (BCS: 3.2±0.3) and milk yield (MY: 0.9±0.2 l/d) basis were offered one of the three different herbage allowances (namely L1, M1 and H1): low (1.4), medium (1.9) and high (2.4 kg DM/d/ewe) respectively. Each group was strip grazed for 3 weeks. Because of the wide heterogeneity of the sward botanical composition, was recorded two or three times a week, the frequency of the species along 2 five meters transects were recorded. In E2, 2 groups of 24 ewes balanced on same criterions (BW: 70±6 kg) (BCS: 3.2±0.2) and milk yield (MY: 1.0±0.3 l/d) basis were offered low (1.4) or medium (1.9) DM herbage allowances (namely L2 and M2). In addition, each group was separated in 2 sub groups allowing either total grazing area of the day since the morning or half the area until midday and the whole area for until milking afternoon (for increasing intake due to new surface offered). In both experiments, 4 (E1) or 8 (E2) ewes per group were daily dosed with Ytterbium oxide as faecal marker. After a 3 weeks adaptation period, faeces were grabbed twice a day during milking for 5 consecutive days during 3 (E1) or 2(E2) weeks. Ytterbium was analysed according to the method of Ellis *et al*. (1982). Total nitrogen in the faeces for organic matter digestibility assessment (Demarquilly *et al*., 1981) was analysed with the Kjeldhal method. Herbage mass and composition were determined 2 or three times a week before grazing. Two or three square meter quadrate were pace at random and grass was cut at 1-2 cm ground level with an electric hand mower. Samples were dried 48h at 60°C and weighed to estimate herbage allowance. Dried samples were grounded with a harmer mill with a 1 mm sieve. Herbage samples were analysed for organic matter (6h in a muffle furnace at 550°C), total nitrogen (Kjeldhal method), NDF and ADF (Van Soest *et al*., 1991) and *in vitro* digestibility (IVDMD) was determined with the pepsine-cellulase method (Aufrère, 1982). Milk composition (total fat and total protein content) was determined by private laboratory.

Statistical analysis

All analysis were performed with the software STATISTICA © 6.1. Animal performances (BW, BCS, MY, FC, PC) were analysed according to the ANOVA one way for each week period. For individual dry matter intake, because of the little animal number and non independent measures we used the non parametric test of Friedman. For comparison within a group between two different periods we applied the non parametric test of Wilcoxon for paired samples. In E2, there was no significant effect of the grazing management (herbage offered in once or two times). Consequently the sub groups were pooled for further statistical analysis. For chemical analysis in E, results were analysed with the ANOVA one way with repeated values.

Results and discussion

In E1, herbage allowance was maintained during the 3 weeks with 1.39±0.05 1.88±0.13 and 2.41 ±0.28 kg DM/d/ewe for L1, M1 and H1 respectively. Paddocks grazed by L1, M1 or H1 had a different botanical composition. Cocksfoot represented 41, 45 and 50%, dandelion (*Taraxacum officinale*) 20, 16 and 18%, white clover 25, 16 and 13% and all other species 15, 23 and 19% for L1, M1 and H1 respectively. In agreement with the botanical composition, the chemical composition of herbage is different (Table 1). L1 group had more dandelion and clover which give a higher crude protein (CP) content and higher IVDMD than M1 or H1 ($P<0.05$).

Table1. Mean ± standard deviation of the chemical composition (g/kg DM) and dry matter digestibility (%) of herbage in E1 (L1, M1 H1) and E2

	L1	M1	H1	E2
OM	896 ± 11	903 ± 13	904 ± 17	897 ± 7
CP	153^{a} ± 12	133^{b} ± 13	124^{b} ± 17	135± 9
NDF	479^{a} ± 49	546^{b} ± 46	554^{b} ± 49	554 ± 9
ADF	259 ± 18	282 ± 21	290 ± 22	278 ± 4
IVDMD	71.5^{a} ± 1.6	67.0^{b} ± 4.5	63.6^{b} ± 4.3	67.7 ± 1.3

Superscript with different letter within a row for experiment E1 are significantly different ($P<0.05$).
OM = organic matter; CP = crude proteins; NDF = neutral detergent fibre; ADF = Acid detergent fibre; IVDMD = *in vitro* dry matter digestibility.

After the first two weeks milk yield decreased (-0.39 l for L1 and –0.25 l for M1 and H1) then increased slightly the last week. However, the differences were not significant between groups. Milk fate content (FC) and protein content (PC) after three week experiment were not significantly different between groups ($P>0.05$). But FC and PC tended to decrease from 90 g/l and 62 g/l to 86 g/l and 60 g/l respectively although the differences are not significant ($P>0.05$).

Live weight decreased for each group during the 3 weeks experiment: -4.0 ($P<0.001$), -3.4 ($P<0.001$) and –2.4 kg for L1, M1 and H1 respectively. The body condition score (BCS) also decreased for each group: -0.3 ($P<0.0004$), -0.2 ($P<0.002$) and –0.1 ($P<0.03$) respectively, but there were not significant differences between groups ($P>0.5$).

According to Bocquier *et al*. (1997) and the fill unit value of herbage estimated with the PrevAlim software (Baumont *et al*., 1999) maximum daily dry matter intake (DMI) would be 2.0 and 2.1 kg for M1 and H1 respectively. These values are in agreement with those measured with Yb marker technique (Table 2) including supplement intake (0.20 kg). Herbage allowance in H1 (2.4) was higher than maximum DMI for H1 as above calculated. However, as H1 ewes did not eat more than 1.7 kg which seems to be the maximum DMI, we can assume that M1 ewes were not limited for herbage intake (herbage allowance = 1.88 kg DM/d/ewe). On the contrary, for L1 ewes, herbage allowance was limited and DMI assessed with Yb indicated that animals eat with no refusal. They did not select any part of the plant.

Requirements for dairy ewes of 65 kg and producing 0.7 l/d of milk with 89 g and 61 g per litre of fat (FC) and protein (PC) content respectively, would be 1.3 NEL (UFL) and 131 g of proteins digestible in the intestine. Only ewes of the M1 group fulfilled the observed requirements from pasture. Taking into account total DMI (namely pasture and dehydrated alfalfa) feed nutritive values, energy and protein balance would be the same for L1 and H1. In L1 group, the higher quality of the pasture (due to higher dandelion and white clover content) balanced the lower DMI. Consequently, we did not observe any significant differences between L1 and M1 or H1.

Table 2. Mean ± standard deviation of pasture dry matter intake (DMI), live weight (BW), milk yield (MY) milk fat (FC) and milk protein (PC) content in E1 and E2

Experiment	E1			E2	
Group	L1	M1	H1	L2	M2
DMI (kg/d/ewe)	1.3^{a} ± 0.3	1.7^{b} ± 0.3	1.7^{b} ± 0.3	0.5^{a}± 0.1	0.7^{b}± 0.1
BW (kg)	66 ± 7	68 ± 5	68 ± 7	65 ± 3	65 ± 3
MY (litre/d)	0.7 ± 0.2	0.8 ± 0.2	0.8 ± 0.2	0.8 ± 0.2	1.0 ± 0.2
FC (g/l)	85 ± 11	88 ± 12	85 ± 6	91 ± 10	95 ± 8
PC (g/l)	61 ± 7	60 ± 5	60 ± 5	55^{a} ± 3	58^{b} ± 5

Superscript with different letter within a row for each experiment are significantly different ($P<0.01$ and $P<0.05$ for E1 and E2 respectively).

In E2, herbage allowance was 1.17±0.22 and 1.90±0.33 kg/DM/d/ewe for L2 and M2 respectively. Paddocks grazed by L2 and M2 were very homogenous in plant species with more than 78% *Lolium multiflorum* and about 6% *Taraxacum officinale* and 6% *Trifolium repens*. Chemical composition of herbage was almost the same for L2 and M2 (Table 1).

Milk yield decreased after the first week experiment (-0.2 and –0.06 l/wk for L2 and M2 respectively) and remained constant the last week. The differences were not significant between groups. Also FC and PC tended to decrease after two weeks but differences were not significant ($P>0.05$). Only PC are significantly different ($P<0.05$) between group at the end of the experiment. Live weight decreased rapidly the first week (-4.3 kg). After 2 weeks total BW lost was of 5 kg ($P<0.0001$). BCS also decreased with: -0.28 ($P<0.0001$) and -0.20 ($P<0.0001$) for L2 and M2 respectively.

Unexpectedly, the estimated DMI (Table 2) was very low compared to herbage allowance. This result is partly in agreement with the BW decrease. The week before, all ewes were conducted as M group with herbage allowance higher than 2.5 kg DM/d/ewe. No clear explanation can support such a low result. Herbage allowance might be over estimated because the very harsh conditions, with sparse pasture, low density (lot of areas without herbage) and low height (6.5 cm on average). Also, organic matter digestibility (OMD) could be under estimated with the faecal nitrogen equation (64.1% on OM basis). On forage analysis basis, OMD would be 71.7% on OM basis. Applying this value to all ewes, average DMI would be 683 g/d and 841 g/d for L2 and M2 respectively.

Conclusion

Dairy ewes in late lactation can sustain a low milk yield with pasture as a sole feed. However, milk fat and protein content unexpectively tends to decrease probably because insufficient energy intake. We may think that on the basis of the E1 experiment, with only 6 /hd access to pasture, energy requirements were not fulfilled with pasture only. However, DMI assessed with Yb faecal marker and faecal nitrogen give very good results according to the predictive equations when herbage allowance is not very limited. More researches are needed in order to fit requirements with pasture.

References

Aufrère, J. (1982). Etude de la prévision de la digestibilité des fourrages par une méthode enzymatique. *Ann. Zootech*., 31: 111-130.

Avondo, M., Licitra, G., Bognanno, M., Keshtkaran, A.N., Marletta, D. and D'Urso, G. (1995). Effects of the type and level of supplementation on grazing behaviour of lactating ewes in a Mediterranean natural pasture. *Livest. Prod. Sci*., 44: 237-244.

Baumont, R., Champciaux, P., Agabriel, J., Andrieu, J., Aufrère, J., Michalet-Doreau, B. and Demarquilly, C. (1999). Une démarche intégrée pour prévoir la valeur des aliments pour les ruminants : PrévAlim pour INRAtion. *INRA Prod. Anim.*, 12: 183-194.

Bocquier, F. and Caja, G. (1999). Effects of nutrition on ewe's milk quality. In: *Proceedings of 5th Great Lakes Dairy Sheep Symposium*, 1999, Brattleboro, Vermont (USA).

Bocquier, F. and Caja, G. (2001). Production et composition du lait de brebis : effets de l'alimentation. *INRA Prod. Anim.*, 14: 129-140.

Bocquier, F., Caja, G., Oregui, L., Ferret, A., Molina, A. and Barillet, F. (2002). Nutrition et alimentation des brebis laitières. *Options Méditerranéennes, Série B,* 42: 37-56.

Bocquier, F., Guitard, J.-P., Vacaresse, C., Van Quackebeke, E., Delmas, G., Guillouet, P., Lagriffoul, G., Morin, E. and Arranz, J.M. (1997). Estimation de la capacité d'ingestion et des phénomènes de substitution fourrage/concentré chez les brebis Lacaune conduites en lots : compilation des données obtenues sur des rations à base d'ensilage. In: Institut de l'élevage and INRA (eds), *Proceedings of 4èmes Rencontres autour des recherches sur les ruminants*, 1997, Paris, France, Paris, France, pp. 75-78.

Demarquilly, C., Grenet, E. and Andrieu, J. (1981). Les constituants azotés des fourrages et la prévision de la valeur azotée des fourrages. In: *Prévision de la valeur nutritive des aliments des ruminants*. INRA publications, Versailles (France), pp. 129-154.

Ellis, W.C., Lascano, C., Teeter, R. and Owens, F.N. (1982). Solute and particulate flow markers. In: *Protein requirements for cattle symposyum,* Owens, F.N. (ed.). Oklahoma State University, Stillwater, pp. 37-56.

Fraysse, J., Lagriffoul, G., Bocquier, F. and Barillet, F. (1996). Brebis laitières : impact de la structure du troupeau et autres facteurs d'élevage sur la composition chimique du lait livré. *INRA Prod. Anim.,* 9: 201-210.

Ligios, S., Sitzia, M., Fois, N., Decandia, M., Molle, G., Roggero, P.P. and Casu, S. (2002). Effet de la disponibilité en herbe et de la structure du couvert herbacé sur l'ingestion et la production de brebis au pâturage. *Options Méditerranéennes*, *Série B*, 42: 73-84.

Molle, G., Decandia, M., Fois, N., Ligios, S., Cabiddu, A. and Sitzia, M. (2003). The performance of Mediterranean dairy sheep given access to sulla (*Hedysarum coronarium* L.) and annual ryegrass (*Lolium rigidum* Gaudin) pastures in different time proportions. *Small Rum. Res*., 49: 319-328.

Molle, G., Decandia, M., Ligios, S., Fois, N. and Sitzia, M. (2002). Grazing management and stocking rate with particular reference to mediterranean environments. In: Pulina, G. (ed.), *Dairy sheep feeding and nutrition*, Bologna (Italy) , pp. 285-313.

Van Soest, P.J., Robertson, J.B. and Lewis, B.A. (1991). Methods of dietary fiber, neutral detergent fiber, and nonstarch polysaccharides in relation to animal nutrition. *J. Dairy Sci*., 74: 3583-3597.