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Effect of concentrate/dehydrated alfalfa ratio on milk yield and composition in Alpine dairy goats fed hay based diets

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SUMMARY – Three proportions of dehydrated alfalfa (DA) to concentrate (C) were given to lactating Alpine dairy goats in a constant amount of 2.2 kg DM/d supplement plus hay given *ad libitum*. Supplements were named: dehydrated (DS: 64% DA), equilibrated (ES: 46% DA) and concentrate (CS: 27% DA). With these highly ingested supplements, intake of hay was low (0.54 to 0.58 kg DM/d). As expected, milk fat content was rather low and milk protein content quite high. Raw milk yield was lower (–0.3 kg/d) in the DS group, and this could be related to the higher milk fat (+1.4 g/kg) and protein (+1.0 g/kg) contents in this group (dilution effect). Fat and protein yields were indeed not different between groups. Finally, the maximum milk energy output was obtained with the diet which supplied the greater amount of concentrate.

Key words*:* Dairy goats, concentrate feeding, milk yield, milk composition.

RESUME *– "Effet de la proportion concentré/luzerne déshydratée sur le rendement et la composition du lait chez des chèvres laitières Alpines recevant des régimes à base de foin". Trois suppléments différant selon leur rapport luzerne déshydratée (DA)/concentré (C) ont été distribués à des chèvres Alpines en lactation à raison de 2,2 kg MS/j. Les chèvres ont reçu du foin à volonté. Les suppléments sont dénommé : déshydratée (DS : 64% DA), équilibré (ES : 46% DA) et concentré (CS : 27% DA). Avec ces suppléments très ingestibles, l'ingestion volontaire de foin a été faible (0,54 à 0,58 kg MS/j). Comme on pouvait s'y attendre avec ces rations, les taux butyreux (TB) sont assez faibles et les taux protéiques (TP) plutôt élevés. La production laitière est plus faible (–0,3 kg/j) avec le régime DS, et ceci peut être relié à l'augmentation du TB (+1,40 g/kg) et du TP (+1,0 g/kg) du lait avec ce régime (effet de dilution). En effet, les productions de matières grasses et de protéines ne différent pas entre les régimes. Finalement, la production laitière maximale est observée dans les lots de chèvres recevant le plus d'aliments concentrés.*

Mots-clès : *Chèvre laitière, supplémentation en concentrés, production laitière, composition du lait.*

Introduction

In the western part of France, and particularly in Poitou-Charentes, there is an increasing interest in feeding goats with conserved dry feeds. Due to the high genetic merit of these goats, these diets are composed of high proportion of concentrate and/or dehydrated forages. The aim of this investigation was mainly to evaluate the effects of these two major components of diets on milk yield and its composition.

Materials and methods

Thirty-six multiparous Alpine goats were randomly allocated to 3 groups and received a hay-based diet, given *ad libitum* (i.e., 15% refusal), with a fixed level of 2.2 kg DM supplement made of different proportions of dehydrated alfalfa (DA) and concentrates (C). The "equilibrated" supplement (ES) was made of practically equal proportions of both feeds (46% DA and 54% C), the "dehydrated" supplement (DS) was mostly made of dehydrated alfalfa (64% DA and 36% C), while the "concentrate" supplement (CS) contained a large proportion of concentrate (27% DA and 73% C). Concentrate was made of 3 feeds i.e., dehydrated sugar beet pulp (59% DM), corn grain (25%) and

soya bean meal (16%). The pre-trial period lasted 2 weeks and the experiment period started at a mean lactation stage of 31 d and lasted 119 d (i.e., 15 weeks).

Results and discussion

Despite the small intake of hay (0.54 to 0.58 kg DM/d), and because of fractionating meals (thrice a day) and of the use of ruminal buffer (sodium bicarbonate: 15 g/d), none of the goat exhibited digestive or metabolic troubles. The CS diet, with the higher net energy density (0.90 UFL/kg DM), induced a small rise in raw milk yield (+2%) when compared to ES diet (0.87 UFL/kg DM). Goats fed the DS diet, with the lowest energy density (0.84 UFL/kg DM), had a lower raw milk yield (–8%; $p < 0.05$) when compared to the ES diet (Table 1). This weakly positive effect of energy density is in general agreement with previously reported observations in dairy goats (Morand-Fehr and Sauvant, 1980).

Table 1. Nutritional value of supplements and goat feed intake and performances during the whole experimental period

Supplements	DS dehydrated	ES equilibrated	CS concentrated	Diet effect
Nutritional value of supplements†				
Energy (UFL/kg DM)	0.92	0.97	1.01	–
Protein PDIN (g/kg DM)	119	116	113	–
Protein PDIE (g/kg DM)	114	119	123	–
Energy density of the diets (UFL/kg DM)	0.84	0.87	0.90	–
Total intake				
Dry matter (kg DM/d)	2.81	2.77	2.80	–
Energy (UFL/d)	2.36	2.40	2.53	–
Protein (PDI g/d)	281	266	260	–
Performances				
Milk yield (kg/d)	3.16[a]	3.43[b]	3.49[b]	$p < 0.04$
Fat content (g/kg)	30.8[a]	29.1[a]	29.7[a]	ns
Protein content (g/kg)	30.8[a]	29.8[b]	29.8[b]	$p < 0.01$
FCM (kg/d)††	2.94[a]	3.10[ab]	3.21[b]	$p < 0.05$
Body weight change (kg)	+3.2	+5.5	+5.9	ns
Energy intake % requirements	124	126	125	–
Protein intake % requirements	155	146	134	–

†One UFL = 7.11 MJ net energy for lactation, PDIN (or E) = Protein Digestible at the level of Intestine when Nitrogen (or Energy) is limiting (INRA, 1988).
††FCM: 3.5% Fat Corrected Milk.
[a,b]Column with different superscripts are statistically different ($p < 0.05$).

With these three types of diets, the milk fat content was relatively low (i.e., around 30 g/kg) while the protein content was rather high (around 30 g/kg) when compared to usual values observed with high yielding Alpine goats. Compared to CS diet, the DS diet induced a tendency for a higher milk fat content (+1.4 g/kg). This may be related to differences in crude fiber (CF) content between DS (22.2% DM) and CS (19.8% DM) diets, since it was shown that a change from 26 to 10% of CF content induced a 4 g/kg decline in milk fat content (Calderon *et al.*, 1984). It is generally accepted, however, that CF is not sufficient to characterise the fibrosity of a diet. There could also be an effect of the concentrate proportion in the diet. However, this negative effect is generally limited (–1 to –3 g/kg milk per kg of concentrate) when this proportion is below 50% (–1.13 g/kg, Mowlem *et al.*, 1985; –3.0 g/kg, Santini *et al.*, 1992). Above 50% concentrate (49 to 63%), the negative effect is higher: (–6.1 g/kg, Santini *et al.*, 1992). A direct comparison with our results (28, 44 and 57% concentrate for SD, SE and SC diets resp.) is, however, difficult because of an inverse proportion of ground dehydrated alfalfa in all three diets. It is more likely that the changes in milk fat content resulted from a dilution effect since fat

yield was not significantly changed by the diets (97, 99, 104 g/d resp.). Furthermore, the milk protein content of goats fed the DS diet was also significantly higher (+1.0 g/kg) than those measured in the 2 other groups. This is not due to better energy balances (Morand-Fehr and Sauvant, 1980) since none of the groups had energy intake below 125% of requirements and because body weight change was similar between groups (Table 1). Then the positive effect of the DS diet on milk protein content is probably due also to a milk concentration effect, related to the decline of milk yield in DS group, because protein yield did not differ between respective treatments (97, 102, 104 g/d).

The fat corrected milk yield (reflecting milk energy output) of goats fed the CS diet was however significantly higher (3.21 kg/d) than the yield of goats fed the DS diet (2.94 kg/d). With the ES diet, the milk yield was in between (3.10 kg/d) and non significantly different from the two other diets.

Conclusion

The effects of these three types of supplements were quite different on both raw milk, milk fat and milk protein contents, thus offering the possibility to manipulate both the milk volume and the milk composition. Finally, the maximum energy output was obtained with the most concentrated diet, which was distributed in this trial with precautions to avoid any digestive or metabolic trouble.

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