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in

Baumont R. (ed.), Carrère P. (ed.), Jouven M. (ed.), Lombardi G. (ed.), López-Francos A. (ed.), Martin B. (ed.), Peeters A. (ed.), Porqueddu C. (ed.).
Forage resources and ecosystem services provided by Mountain and Mediterranean grasslands and rangelands

Zaragoza : CIHEAM / INRA / FAO / VetAgro Sup Clermont-Ferrand / Montpellier SupAgro
Options Méditerranéennes : Série A. Séminaires Méditerranéens; n. 109

2014
pages 385-389

Milk production without wet forage for Saint-Nectaire PDO cheese

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Abstract. In a few years the new specifications of the Saint-Nectaire PDO cheese will prohibit the use of wet forage like grass silage, forcing a number of producers to change their winter feeding. Therefore, INRA and Saint-Nectaire inter-profession association implemented an experiment to optimize milk production during a complete lactation with an 'all hay' winter diet, in comparison with a silage diet, associated with the maximum amount of concentrate permitted (30% over the year). Two groups of 15 autumn calving cows were compared for 305 days of lactation: a Silage group fed during winter with a '50% grass silage-hay-concentrate' diet; a Hay group fed with a 'hay-concentrate' diet. At pasture, the 30 cows were kept together on a rotational grazing system. During the first 14 weeks of lactation, Silage cows ingested more forage than Hay cows (12.3 *vs.* 10.9 kg/d on total winter period). The lowest milk production of Hay cows (-343 on 7740 kg/y, *ns*) took place essentially during winter. The difference is less pronounced for multiparous than for primiparous (-113 *vs.* -801 kg/y), penalized by the lower energy density of the hay diet, their limited intake capacity and their growth needs. Finally, the experiment was enriched by simulations with the Dynamilk model, which allowed extrapolating the results to other harvesting or grazing conditions.

Keywords. Milk production – PDO cheese – Mountain areas – Grass-based system – Hay.

Production laitière permise par le cahier des charges sans fourrage humide de l'AOP Saint-Nectaire

Résumé. *Le futur cahier des charges du fromage AOP Saint-Nectaire, sans fourrage humide, va obliger de nombreux producteurs à modifier leur alimentation hivernale. L'Inra et l'interprofession du Saint-Nectaire ont donc mis en place une expérimentation visant à optimiser la production laitière sur une lactation complète (305 jours) d'animaux recevant une alimentation hivernale "tout foin", associée à la quantité maximale de concentré autorisé (30 % sur un an). Deux lots de 15 vaches vêlant en automne ont été comparés : un lot témoin Ensilage recevant un régime hivernal "50% ensilage d'herbe-foin-concentré" ; un lot Foin recevant un régime "foin-concentré". L'été, les 30 vaches ont été conduites ensemble en pâturage tournant. Pendant les 14 premières semaines de lactation, les vaches Ensilage ont ingéré plus de fourrage que les vaches Foin (12,3 vs 10,9 kg/j sur l'ensemble de la période hivernale). La plus faible production laitière des vaches Foin (-343 kg/an, ns) a eu lieu essentiellement l'hiver. La différence est moins marquée chez les multipares que chez les primipares (-113 vs -801 kg/an), pénalisées par la densité énergétique plus faible de la ration foin, par leur capacité d'ingestion limitée et par leur besoin de croissance. Enfin, l'expérimentation a été enrichie par des simulations effectuées avec le logiciel Dynamilk, qui ont permis l'extrapolation des résultats à d'autres conditions de récolte ou de pâturage.*

Mots-clés. *Production laitière – Fromage AOP – Zone de montagne – Système herbager – Foin.*

I – Introduction

Since 2007, the specifications for the production of Saint-Nectaire PDO cheese indicate that forage preserved by wet process should not exceed 50% of total winter forages and limit concen-

trate to 30% of the total annual diet of dairy cows. The use of this type of forage will be completely forbidden in 2020, forcing number of producers to change their winter feeding.

Therefore, in cooperation with Inra, the Saint-Nectaire inter-profession wished to implement an experiment as a «local demonstration» at the Monts d'Auvergne Experimental Unit, with 3 objectives: (i) to optimize, on a complete lactation, milk production (in quantity and quality) permitted by a winter diet "all hay", associated with the maximum annual intake of concentrate permitted by the PDO specifications; (ii) to compare this production (in quantity, quality and distribution over the year) with that permitted by a winter diet "50% grass silage", associated with an equivalent amount of concentrate (30%); and (iiI) to extrapolate the responses obtained during the experiment with other harvesting or grazing conditions, by simulations performed with the Dynamilk model (Jacquot *et al.*, 2012).

II – Materials and methods

Two identical groups of 15 Holstein cows were constituted prior to calving on expected calving date (05/12), rank of lactation (33% of primiparous), live weight (654 kg) and previous dairy production (7 836 kg/y) or milk index for primiparous (+669): one called 'Silage' group and the other 'Hay' group. The experiment was divided into 3 periods: a 4-week period before calving (from wk-4 to wk-1) when the animals began to receive the winter diet corresponding to their group; a winter period (from the 1st day of lactation until pasture) when the animals received their corresponding winter diet; a summer period (from the 1st day at pasture to the 305th day of lactation) when all the animals grazed together but received individually their concentrate.

The winter forages came from 5 plots of semi-natural grassland, divided in two equivalent parts, one for Silage group harvests and the other for Hay group harvests. The characteristics of the 4 types of forage harvested on these plots, the two winter diets and the two concentrates are summarized in Table 1. During the winter period, each cow received ad libitum a mixed diet corresponding to its group and, during the 3 periods, a fixed amount of concentrate corresponding to its group, rank and stage of lactation. Due to a 4-week delay between silage and hay harvests, the energy value of the latter was 18.6% lower. Nevertheless with the same duration of regrowth, the two "2nd cut" hays had close compositions. Thus, compared to the Silage diet, the Hay diet differed only by -9.1% in energy value and +11.7% in crude fiber during winter.

Table 1. Composition and nutritive values of the feeding components

	Crude Protein *(%)*	Crude Fiber *(%)*	Ashes *(%)*	Feed Unit	Fill Unit
A = Grass silage *(1st cut on 29 May, 35% DM)*	13.2	26.1	11.7	0.86	1.08
B = Hay *(2nd cut, 10.3 wk. after grass silage cut)*	13.9	25.1	12.3	0.76	1.03
C = Hay *(1st cut on 23 June)*	8.8	31.8	9.1	0.70	1.10
D = Hay *(2nd cut, 11.0 wk. after 1st cut hay)*	13.2	25.9	12.4	0.80	1.02
Silage diet = 50% **A** + 35% **B** + 15% **C** *(on DM basis)*	12.8	26.6	11.5	0.80	1.06
Hay diet = 65% **C** + 35% **D** *(on DM basis)*	10.3	29.7	10.3	0.73	1.07
Winter concentrate *(cereal and by-products pellets)*	15.0	7.7	5.8	1.00	
Summer concentrate *(barley pellets)*	11.6	5.2	2.6	1.09	

The strategy for concentrate distribution was established before the beginning of the experiment. It was adjusted at mid-winter and at turn-out to pasture, to fit better the target of 30% of concentrate over the year in each group, with 34.5% for the primiparous and 27.8% for the multiparous,

due to their respective needs. The maximum amount of concentrate was limited to 10 and 12 kg/d respectively, with 3 distributions by day in order to avoid acidosis troubles.

All experimental measurements were individual: milk production (at each milking), milk composition (fat content, protein content and somatic cell count, on 4 consecutive milkings each week), intake of forage and concentrate (quantities offered and consumed, on 3 consecutive days each week), live weight (every 2 weeks), body condition score (on a 0 to 5 scale, once a month) and health problems. The statistical analysis was performed with a mixed model including the group, the lactation rank, the calving date and, when it exists, a representative covariate (SAS, 2008).

The characteristics of the two "systems" and the results of the experiment were used to parameterize and calibrate the Dynamilk model. This allowed to simulate milk production of the Hay group, during winter with 3 qualities of hay and during summer with 3 weather conditions.

III – Results and discussion

We observed no difference between groups on health status, but we had to remove 2 cows from the statistical analysis: one Hay primiparous (actinomycosis of the digestive tract) and one Silage multiparous (accident with the automatic cleaning system of the cowshed).

Intakes of winter forages and concentrates are presented in Fig. 1. Up to the 14th week of lactation, Silage cows ingested more forage than Hay cows. Beyond, values became statistically identical and it should be the same at pasture, with two groups of same weight and same milk production (see below), grazing together on same plots. During winter, concentrate intakes are identical between the two groups (1 485 *vs.* 1 488 kg DM/cow, *ns*), due to the protocol limitation. During summer, in order to reach the same annual percentage of concentrate for the two groups, a higher amount of concentrate was distributed to the Silage group (423 *vs.* 368 kg DM/cow, $P<0.001$) because it had ingested previously more forage than the Hay one (1 807 *vs.* 1 626 kg DM/cow, $P<0.001$). This difference is due to the bulky and coarser forage that quickly saturates the capacity of ingestion of the Hay cows, particularly for two-year-old primiparous (-230 kg DM *vs.* -157 kg DM for multiparous). Furthermore, we estimated the percentage of concentrate over the year to 28.4 and 28.7% for Silage and Hay groups, close to the maximum of 30% allowed, with the assumption of 14 kg/d DM of grass ingested at pasture (and +50 kg of concentrate for Silage cows over the season).

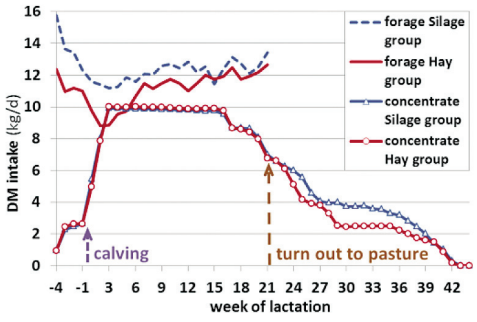

Fig. 1. Controlled intakes of Silage group and Hay group over the complete lactation.

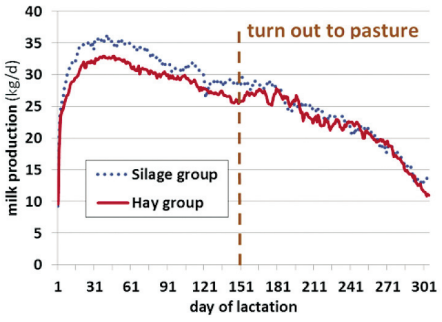

Fig. 2. Individual milk production of Hay and Silage cows during 305 days.

We can see in Fig. 2 and Table 2 that the higher annual milk production of Silage cows (+343 kg, *ns*) took place essentially during the winter period (+383 kg, $P<0.05$), when animals received identical quantities of concentrate. This moderate difference is the result of an addition of a small dif-

ference of milk production between multiparous of the 2 groups (+113 kg, *ns*) and an important one between primiparous (+801 kg, *P*<0.001). It seems therefore entirely due to the higher ingestion of best quality forages as seen before, in particular for two-year-old primiparous. During the experiment, milk composition, LW and BCS were not significantly different between the two groups (Table 3), except for BCS at the end of winter that tended to be higher for Silage cows (+0.31, *P<0.10*).

Table 2. Individual milk productions of Silage and Hay cows *(in kg)*

	Silage	Hay	*P*
Winter milk	4 713	4 330	*
Summer milk	3 369	3 410	*ns*
305 days milk	8 083	7 740	*ns*
Primiparous milk	7 532	6 731	***
Multiparous milk	8 358	8 245	*ns*

*: P<0.05, ***: P<0.001, ns: non-significant.

Table 3. Milk composition, LW and BCS of Silage and Hay cows

	Silage	Hay	*P*
Milk fat content *(g/kg)*	36.9	37.3	*ns*
Milk protein content *(g/kg)*	29.1	29.4	*ns*
LW at 44 wk. *(kg)*	624	612	*ns*
End of winter BCS *(0-5)*	1.68	1.37	+
BCS at 44 wk. *(0-5)*	1.70	1.50	*ns*

+: P<0.10, ns: non-significant.

One of the limitations of the results obtained during this experiment is that they closely depend on weather conditions during harvesting and grazing periods. To go further, we simulated the winter milk production of the Hay group with 3 energy values of hay, corresponding to a more or less favorable weather at harvest: one harvested at heading stage (0.73 UFL/kg DM, usual in the Saint-Nectaire area), one harvested 2 weeks before (0.82 UFL) and one harvested 2 weeks later (0.63 UFL). Compared to the intermediate situation, the differences calculated by Dynamilk are respectively +323 and -292 kg/cow of winter milk production (Fig. 3). We also simulated the summer milk production with “typical” weather conditions (2010), with a hot spring (2011) and with a summer drought (2005). Surprisingly, even if the distribution is different, the summer milk productions are not really different (+9 and -19 kg/cow for 2011 and 2005, compared to 2010).

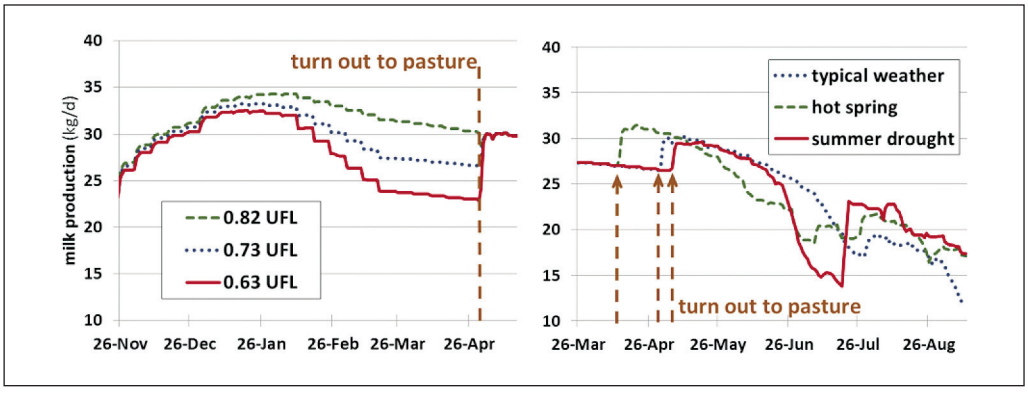

Fig. 3. Simulation by Dynamilk of the Hay group milk production *a)* with 3 energy values of hay *b)* with 3 contrasted weather conditions at pasture.

IV – Conclusions

The weak difference in milk production (-343 kg/cow with -50 kg of concentrate) observed in the experiment with the new Saint-Nectaire specifications reflects mainly the important percentage of two-year-old primiparous. Concerning feed, the role of silage is not as important as expected because its proportion represents only 16% of the annual diet, replaced by hay. For this reason, as shown by the simulations, Saint-Nectaire producers should especially focus on the best date to harvest their hay (or invest in a hay drier because of the weather) and on the management of their pastures (e.g. with an earlier turning-out), which represent 40% of the annual intake.

References

Jacquot A.-L., Baumont R., Delaby L., Pomiès D., Lamadon A. and Brunschwig G., 2012. Dynamilk: Un modèle à l'échelle de l'exploitation bovine laitière herbagère pour explorer l'adéquation entre les dynamiques des productions d'herbe et de lait. In: *Renc. Rech. Ruminants*, 19, p. 265-268.

SAS, 2008. SAS/STAT® 9.2 User's Guide. SAS Institute Inc, Cary, NC, USA.