Milk performance of two cow breeds at two levels of supplementation in long residence time grazing paddocks

Ana Isabel Roca Fernandez, Antonio González-Rodríguez, S. Leurent, M.E. López-Mosquera, Yves Y. Gallard, Luc Delaby

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Roca-Fernández A.I.[1,2], González-Rodríguez A.[1], Leurent S.[3], López-Mosquera M.E.[2], Gallard Y.[3] and Delaby L.[4]
[1]*INGACAL, Agrarian Research Centre of Mabegondo, 15080 La Coruña, Spain*
[2]IBADER, *University of Santiago de Compostela, 27002 Lugo, Spain*
[3]*INRA, Experimental Farm, UE 326, Le Pin au Haras, Borculo, 61310 Exmes, France*
[4]*INRA, Agro-Campus Ouest, UMR Production du Lait 1080, 35590 Saint Gilles, France*
Corresponding author: anairf@ciam.es

Abstract

Milk performance of four groups of cows (H0, H4, N0 and N4) was studied under grazing: two cow breeds, Holstein-Friesian (H) vs. Normande (N), supplemented at pasture with two levels of concentrate, low vs. high (0 and 4 kg cow^{-1} day^{-1}). A simplified rotational grazing system using three paddocks per rotation with a mean residence time per paddock of 10-days was examined. During this long residence time, maximum milk yield (MY max.) was reached at day 4 followed by a milk yield drop (Dm) at the end. Milk production was higher ($P < 0.001$) in Holstein-Friesian than in Normande cows (7,452 over 6,067 kg cow^{-1} year^{-1}). Supplemented cows produced more ($P < 0.001$) milk than unsupplemented cows (7,570 over 5,949 kg cow^{-1} year^{-1}). In each 10-day grazing cycle, supplemented cows had higher ($P < 0.001$) peak (MY max., 25.6 kg cow^{-1}) and less ($P < 0.001$) drop (Dm – 5.3 kg cow^{-1}) than those without concentrate (21.2 and – 5.7 kg cow^{-1}). The peaks and drops of milk yield were higher ($P < 0.001$) in Holstein-Friesian (25.5 and – 6.2 kg cow^{-1}) than in Normande cows (21.3 and – 4.7 kg cow^{-1}). When long-residence grazing paddocks are used, these peaks and drops of milk yield are important factors to control for a good milk performance considering both the cow breeds and the supplementation effects.

Keywords: simplified rotational grazing system, residence time, milk peaks and drops, cow genotypes, supplementation effects

Introduction

It is important to reduce management practices, number of paddocks, fencing and labour in farm conditions. Delaby *et al*. (2009) investigated during 5-years the whole lactation response of two cow breeds, Holstein-Friesian (H) vs. Normande (N), managed at two parities, primiparous vs. multiparous, applying the simplified rotational grazing system in Normandy (France) and using low rates of supplementation at grazing by feeding two levels of concentrate, 0 vs. 4 kg cow^{-1} day^{-1}. As part of this work, we focus our research in determining the maximum of milk yield (MY max.) and the drop of milk (Dm as the difference between the last-day milk and the max. milk yield in a paddock) in each grazing cycle for a long residence time in a paddock (on average 10-days), defined by Hoden *et al*. (1991), during the whole grazing season of 9-years in a similar experiment.

Materials and methods

The study was conducted from 2001 to 2009 at the INRA experimental farm of 'Le Pin au Haras' in France. The location is a grassland zone with drained permanent pastures and sown pastures of perennial ryegrass either pure or associated to white clover.
Experimental Design and Treatments. In November of each year, a mean of 72 dairy cows (Table 1) were randomly assigned in a block design with a 2×2 factorial arrangement of

four grazing treatments (H0, H4, N0 and N4). The experiment investigated the milk performance of two cow breeds, Holstein-Friesian (H) vs. Normande (N), under two grazing feeding regimes, without vs. with concentrate (0 vs. 4 kg cow^{-1} day^{-1}), managed at two parities, primiparous vs. multiparous, across successive lactations during a 9-year period. The objective was to determinate the MY max. in each grazing cycle and the Dm in both cow breeds for both grazing feeding regimes.

Table 1. Number of selected grazing cycles by year from the total observed during a 9-year period and number of cows at different breeds, concentrate levels and parities

					Holstein-Friesian[3]		Normande		Concentrate[4]	
Year	Total Cycles[1]	Selected Cycles[2]	Grazing Data	Number of Cows	Prim.[5]	Mult.	Prim.	Mult.	0 kg	4 kg
2001	27	5	340	68	19	16	14	19	34	34
2002	24	6	433	72	16	19	10	27	35	37
2003	26	5	338	68	15	21	13	19	33	35
2004	24	7	487	70	22	16	10	22	34	36
2005	27	5	368	74	14	20	16	24	38	36
2006	25	4	285	74	12	23	18	21	38	36
2007	30	5	369	76	19	17	13	27	40	36
2008	27	4	288	72	16	18	11	27	37	35
2009	28	4	288	72	12	18	21	21	36	36
Total	238	45	3196	646	145	168	126	207	325	321
Average	26	5	355	72	16	19	14	23	36	36

Total number of [1]observed and [2]selected grazing cycles by year; [3]Cow Breeds (Holstein-Friesian vs. Normande); [4]Concentrate Levels (0 vs. 4 kg cow^{-1} day^{-1}); [5]Parities (primiparous vs. multiparous).

Grazing Management. During each rotation, the same total area was allocated to the four grazing groups to obtain the same average stocking rate of 4.0 cows ha^{-1} in spring and 2.2 cows ha^{-1} in autumn. The decision to change paddock was made according to the evolution in milk yield profile of the group receiving 4 kg day^{-1} of concentrate. The paddock was changed when milk production over the previous 3 days corresponded to 85–90% of the maximum milk yield value observed on the paddock (Hoden *et al*., 1991). Cows without concentrate also changed paddock at this rate to get more severe grazing.

Results and discussion

The highest milk performance was reached by H4 (8,407 kg cow^{-1} year^{-1}) and the lowest by N0 (5,401 kg cow^{-1}) with the other two groups (H0, 6,497 and N4, 6,733 kg cow^{-1} year^{-1}) in between (Figure 1). Milk yield was higher ($P < 0.001$) in Holstein-Friesian cows than in Normande. Supplemented cows produced more ($P < 0.001$) milk than unsupplemented. No significant interactions were found between cow breeds, concentrate levels and parities on MY max. and Dm on the selected grazing cycles during a 9-year period (Table 2). The MY max. at day-4 and Dm at day-10 were higher ($P < 0.001$) in Holstein-Friesian (25.5 and – 6.2 kg cow^{-1}) than in Normande cows (21.3 and – 4.7 kg cow^{-1}). The group of cows fed concentrate at pasture (4 kg cow^{-1} day^{-1}) showed higher ($P < 0.001$) MY max. and slightly lower ($P < 0.001$) Dm (25.6 and – 5.3 kg cow^{-1}) than unsupplemented cows (21.2 and – 5.7 kg cow^{-1}). Multiparous cows (25.3 and – 6.1 kg cow^{-1}) had higher MY max. ($P < 0.001$) at day-4 and Dm at day-10 ($P < 0.001$) than primiparous cows (21.5 and – 4.9 kg cow^{-1}). Good control of Dm in long residence time grazing paddocks helped us to maintain milk reduction steady throughout the lactation.

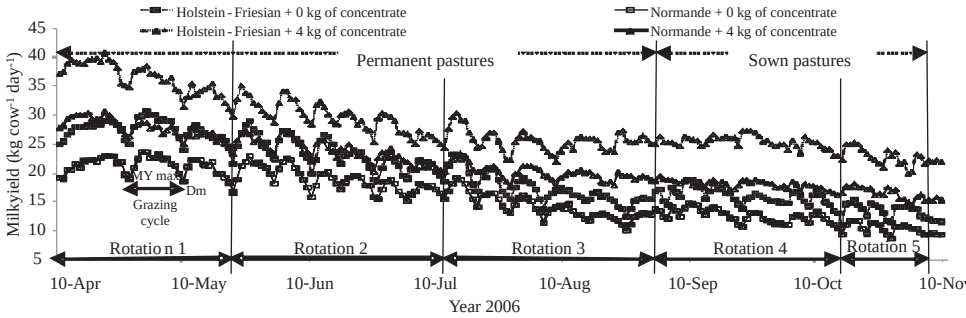

Figure 1. An illustration of the within paddock milk profile and of the milk performance of two cow breeds at two levels of concentrate in 2006

Table 2. Effect of two cow breeds and two grazing feeding regimes on the maximum of milk yield and the drop of milk in each grazing cycle during a 9-year period

		Holstein-Friesian[3]		Normande			Significance[5]			
Item[1]	Parity[2]	0 kg[4]	4 kg	0 kg	4 kg	SEM	Gen.	Conc.	Par.	GxCxP
MY max.	Prim.	21.2^{a}	25.8^{b}	17.9^{c}	21.1^{a}	0.15				
	Mult.	24.8^{a}	30.2^{b}	20.8^{c}	25.2^{d}	0.12				
	Average	23.0^{a}	28.0^{b}	19.4^{c}	23.2^{a}	0.14	***	***	***	ns
Dm	Prim.	–5.8^{a}	–5.4^{b}	–4.3^{c}	–3.9^{d}	0.06				
	Mult.	–7.0^{a}	–6.6^{b}	–5.5^{c}	–5.1^{d}	0.05				
	Average	–6.4^{a}	–6.0^{b}	–4.9^{c}	–4.5^{d}	0.05	***	***	***	ns

[1]Item: MY max. (Maximum of milk yield) and Dm (Drop of milk); [2]Parity (primiparous vs. multiparous); [3]Cow Breeds (Holstein-Friesian vs. Normande); [4]Concentrate Levels (0 vs. 4 kg cow^{-1} day^{-1}); [5]Significance: SEM = Standard Error of the Mean; $^{a–d}$Means within a row with different superscripts differ significantly ($P < 0.05$). ns = Not significant; ***$P < 0.001$; **$P < 0.01$; *$P < 0.05$.

Conclusions

Milk yield drop was observed in all treatment groups at the end of the 10-days resident time when using a simplified rotational grazing system of three paddocks. Despite this cyclic variation, cows did not show any negative effect on milk performance over the whole lactation. The results point to the importance of controlling the drop of milk yield, while getting a good grazing in each long residence paddock, without penalizing milk performance of dairy cows.

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