

## Which compromise between milk production and cow-calf contact in dairy systems?

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### Abstract

*In organic dairy farms, cow-calf contact is encouraged until weaning and requested by society. However, farmers question this practice, especially because of the loss of marketable milk. At INRAE experimental farm 'Herbipôle', we tested two different suckling strategies on animal performance and behaviour. A 14-cow 'Classic' rearing system (C group) was compared during 14 weeks to two suckling systems. In the C group, calves were separated from dams immediately after birth and fed with an automatic milk feeder until weaning. In the 'Dam' group (D), dam-calf contact was allowed from birth to weaning, between morning and evening milking. In the 'Mixed' group (M), calves were kept with dams until three weeks (as in D group) before being separated and reared as in C group. All calves were weaned at about 11 weeks. On average, over 14 weeks, D and M cows produced 25.1% less milk at parlour than C cows; milk fat content was 3.6 g/kg lower in D group compared to C and M, and milk protein content was intermediate between C and M. After 11 weeks, D-calves weighed 20.5 kg more than C and M calves. Cows and calves both vocalised for one week after separation or after weaning. All calf vocalisations were at a maximum during the first four days. Cows' vocalisations were less notable when calves were removed after three weeks compared to 11. In conclusion, a three-week suckling period seems better for farmers' income and cows' distress, but it induces stress for calves at both separation and weaning, without benefit on growth.*

### Introduction

In organic dairy farms, cow-calf contact is encouraged until weaning and requested by society (Agenäs et al. 2017). However, calves are usually fed natural milk until 12 weeks, instead of maternal milk as suggested by the organic guidelines, due to being separated from their dam shortly after birth. Long-term cow-calf contact can promote animal welfare and improve health and growth of calves (Roth et al. 2009). By contrast, a short contact period decreases the marketable milk loss for the farmer and is believed to reduce stress at separation. The aim of this study was to investigate a rearing system that would represent the best compromise between cow-calf contact, animals' performance and stress at separation or weaning.

### Material and methods

The experiment took place in 2019 at the INRAE Herbipôle experimental farm (DOI: <https://doi.org/10.15454/1.5572318050509348E12>), located in Marcenat (F-15114,

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45.30°N, 2.84°E, 1080 m a.s.l.). All procedures were approved by the local animal ethic committee and followed the guidelines for animal research of the French Ministry of Agriculture and all other applicable national and European regulations.

During 14 weeks after calving, performance and behaviour of three groups of 14 cows and corresponding calves were compared. Cows groups were balanced according to breed (Holstein or Montbéliarde), lactation rank, date of calving, and milk index. The 42 cows were housed in the same free-stall barn, divided into three pens. They calved regularly from 12 February to 5 May and moved to the milking parlour each day at 6:30 and 15:30. They were fed *ad libitum* with a mixed ration (59% 1<sup>st</sup>-cut hay; 32% 2<sup>nd</sup>-cut hay; 9% concentrate), plus 2 kg/d of concentrate per cow. From the 5 May, cows were grazing day and night and received 2 kg/d of concentrate. In the Control group (**C**), calves were separated at birth and received at least two litres of fresh colostrum with a feeding bottle (or thawed and reheated if the quality was <24% Brix, measured by refractometer). Calves were housed in individual pens for seven days and bucket-fed bulk milk twice a day. They were thereafter placed in a collective straw-bedded pen with a hay rack and received bulk milk and concentrate by automatic feeders according to a feeding plan (*milk: 6 to 9 kg/d from wk1 to wk3; 10 kg/d from wk4 to wk6; 9 to 3 kg/d from wk7 to wk10 – concentrate: 0.2 to 2.0 kg/d from wk3 to wk10*). In the 'Dam' group (**D**), calves spent five days after birth in individual calving pens with their dam and received colostrum directly from their dam. Thereafter, D-calves were housed in a collective straw-bedded pen next to their dam. From 9:00 to 15:30, calves had free access to the D-cowshed where they were suckled by the dams. From 15:30 to 9:00, the separation gate was closed but calves could see their dam. Calves had free access to a hay rack and a bucket of concentrate. In the 'Mixed' group (**M**), calves were reared as calves of the D group until 3 weeks of age, before being separated and reared as calves of the C group. The day of separation, calves were moved to a remote pen, and cows stayed in the collective barn with the remaining dam-calf pairs.

Five male calves of each group were removed from their respective pen after 21 days of age, to be sold. Remaining calves were weaned when they weighed about 100 kg (corresponding to 11 weeks of age, on average) and were moved to collective pens. Separation of males for selling, separation of M-calves from their dam and weaning took place in waves every two weeks during the Tuesday morning milking.

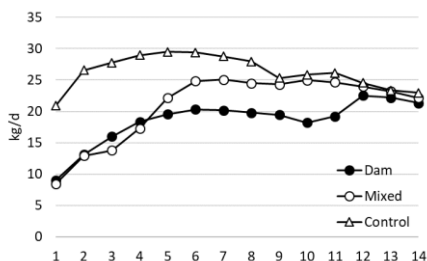
Individual milk yield was measured twice a day at the milking parlour with DeLaval flow meters. Milk fat and protein contents were determined weekly on four consecutive milkings by mid-infrared spectroscopy and milk somatic cell count (**SCC**) was measured by epifluorescence on two consecutive milkings. This allowed for calculation of the average individual milk yield and composition by week of lactation. Calves were weighed at birth and then weekly until 14 weeks. We observed the behaviour of calves and cows at separation (M group) and at weaning (except C-cows), during one week: the day before the separation/weaning (Day0), the day of the separation/weaning (Day1), and on days 2, 4 and 7. Calves and their respective dam were observed twice a day at the same time, in the morning and in the evening, during two periods of 5 min to note if they vocalised or not.

The data were analysed using the MIXED procedure of SAS software. The model for milk included the effects of the cow (random factor), rearing group (Classic, Dam or Mixed), breed (Holstein or Montbéliarde), parity (primiparous or multiparous), week of lactation (repeated factor), date of calving, and the group\*breed and group\*week interactions. For the analysis of calves' weight around weaning (week 11, on average), the model included the effects of rearing group, breed, calf sex, date of birth, birth weight and the group\*breed interaction. Finally, we calculated the daily percentage of animals that vocalised, by group and by type of animal (calf or cow).

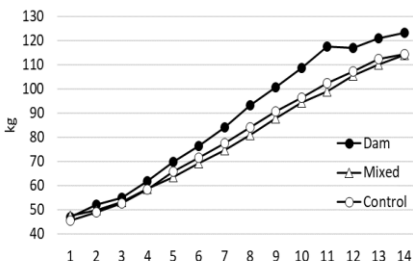
## Results

Milk yield at parlour of M-cows was similar to that of D-cows until the separation of calves (week 4). From there, production increased to reach that of C-cows on week 9 (Figure 1). Milk yield at parlour of D-cows increased after the weaning of the last calves (week 12) to reach that of M- and C-cows. Over 14 weeks, M- and D-cows produced 20.5% and 29.7% less milk at parlour than C-cows (Table 1). Milk fat content was lower in D group compared to C and M groups (-3.6 g/kg, on average) and protein content was lower in C group compared to D group (-1.0 g/kg;  $P=0.089$ ) and M group (-1.6 g/kg;  $P=0.011$ ). Milk SCC was not significantly different between the three groups.

Until four weeks of age, the growth of the three groups of calves was identical (616 g/d; Figure 2). Between weeks 5 to 11, D-calves had a higher growth (1139 g/d) than M and C-calves (845 and 875 g/d). At 11 weeks of age, around weaning, D-calves weighed on average 20.5 kg more than M- and C-calves (120.3 vs 99.5 kg, on average ;  $P<0.001$ ). After weaning, the growth of D-calves dramatically slowed down (266 g/d between weeks 11 and 14) whereas C- and M-calves were less impacted (641 g/d on average). On week 14, D-calves still weighed 8.9 kg more than M- and C-calves ( $P<0.05$ ).



**Figure 1. Average daily milk yield at parlour by week of lactation**



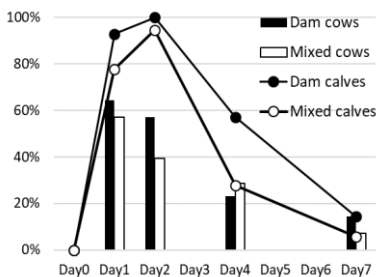
**Figure 2. Average weight of calves by week of age**

**Table 1: Average milk yield and composition during the first 14 weeks after calving, according to the rearing group (adjusted values)**

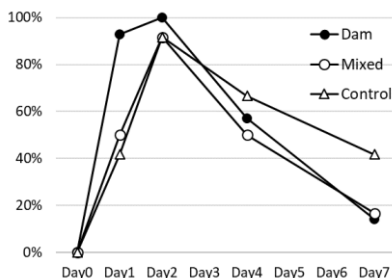
	Control	Mixed	Dam	P-value
Milk yield at parlour (kg/d)	26.3 <sup>a</sup>	20.9 <sup>b</sup>	18.5 <sup>b</sup>	<0.001
Milk fat content (g/kg)	37.2 <sup>a</sup>	36.3 <sup>a</sup>	33.2 <sup>b</sup>	0.007
Milk protein content (g/kg)	29.9 <sup>a</sup>	31.5 <sup>b</sup>	30.9 <sup>ab</sup>	0.034
Milk Somatic cell count ( $\log_{10}/\text{mL}$ )	4.73	4.82	4.84	0.817

<sup>a,b</sup> Means within a row with different superscript letters differ at  $P<0.05$

After separation, in M and D groups, the percentage of cows and calves that vocalised was the highest on days 1 and 2 (54% and 91% on average for cows and calves, respectively), then it decreased regularly until Day7 (Figure 3). From Day1 to Day7 it was higher for D-cows (6.7-point) and calves (14.7-point) compared to M-cows and calves. After weaning, the percentage of calves that vocalised was the highest on Day2 (94%, on average), then it decreased regularly until Day7 (Figure 4). On Day1, this percentage was two times higher for D-calves (93%) than for C- and M-calves (46%, on average). Conversely, on Day7, the percentage of calves that vocalised was more than two times higher in C group (42%) than in D and M groups (15%).



**Figure 3. Percentage of animals that vocalised after separation (Day1)**



**Figure 4. Percentage of calves that vocalised after weaning (Day1)**

## Discussion

Compared to a classic rearing system of dairy calves, both suckling systems affected production: less milk was collected at the parlour, with a lower fat content in the case of very late separation, and a higher protein content. This loss is higher (764 kg by cow; adjusted value) than the amount of milk consumed by the same number of calves fed bulk milk with an automatic feeder (396 kg by cow; raw data). For a farmer, this difference represents only about 6.1% of the total production of his herd (considering 6 000 kg by lactation). However, a long-term contact with dams improved the growth of calves, which was not the case with a short contact period. This may be due to the stress of the separation combined with the need to cope with the automatic feeder. Separation and weaning are very stressful events for calves because, whatever the group, they all vocalised the following day. Separation seemed less stressful for cows, especially when calves were removed after a few weeks. However, whether at separation or at weaning, some cows and calves still vocalised one week after. In conclusion, a three-week suckling period seems better for farmers' income and cows' distress, but it induces two periods of stress for calves (separation then weaning) instead of one (simultaneous separation and weaning), without benefit on growth. Conversely, the coincidence of separation and weaning after three months induces a strong slowdown of calves' growth.

## Suggestions for research and support policies to develop further organic animal husbandry

Rearing dairy calves with their dam until weaning, or at least for few weeks, must be more strongly encouraged in organic farming. For the farmer, marketable milk loss should be compensated by a higher price for a milk labelled "from cows suckling their calves". Further research on the implementation of a gradual weaning, or a weaning without separation, is needed to reduce the stress of both calves and cows. <sup>[1]</sup>

## References

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