Use of flavouring and appetising substances in an automatic milking system

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Abstract - *A comparison between a neutral concentrate and four differently treated concentrates fed in an automatic milking system was conducted. All the concentrates were composed of 50% wheat bran and 50% corn meal, on a wet basis. The four treatments were as follows: P1 "aroma", neutral feed with flavour, type fenugreek, added at 450 g/t; P2 "sweetener", neutral feed with natural highly intensive sweetener, added at 500g/t; P3 "aromatic + sweetener", neutral feed with P1 (150 g/t) + P2 (500 g/t); P4 "taste modifier", neutral feed with a flavour containing strong gustatory characteristics, liquorice type. Added at 500 g/t. There were no significant differences in milk yield, milking frequency, and milking interval between neutral and flavoured product . The number of passages through the pre selection gate was higher with P3 than with the neutral feed (4.43 vs. 3.88 d-1; P = 0.14); this trend was confirmed, even if in a small extent, from the number of milkings per day (2.52 vs. 2.44).*
Key words : automatic milking, milk yield, milking number, milking interval, pre-selection gate visits.

Introduction

The application of Automatic Milking Systems (AMS) represents a substantial innovation in dairy cattle husbandry, having determined one of the fastest technological changes remembered in the milk production industry. However, the introduction of a new technology, as often happens, puts some new questions about cow management.

To study the main problems related to the introduction of an AMS, research projects have been granted by MiPAF and Regione Lombardia to the Dairy Cattle Section of the Animal Production Research Institute in Cremona.

A correct and regular flow of animals through the milking unit appears fundamental to improve efficiency of AMS, animal welfare and performances.

An optimal animal flow, in fact, allows: a) to improve the number of milkings per cow, with positive effects on the production; b) to reduce average waiting time of the cows before to enter in the milking stall, reducing animal stress; c) to improve nutrient supply, with a better distribution of the feed intake during the day; d) to increase the number of milking per robot.

Possible causes of flow slowing down are: 1) lack of habit (particularly for new animals); 2) excessive cow density; 3) traffic system; 4) lack of attraction to the robot and/or towards the food area or robot self-feeder (Harms et al., 2002). An elevated number of cows with a low frequency of visit to the AMS (lazy cows) is the major cause of failure of robotic milking.

Preliminary observations have suggested that animals go into the robot station more for food attraction than for milking need (Prescott et al., 1998).

To avoid the slowing down and to minimize the number of lazy cows it is possible to increase the amount of concentrate in the self-feeder of the robot. Otherwise, if a too high amounts of concentrate is considered detrimental, the use of appetizing and flavouring substances can be considered.

The supply of limited amount of flavoured concentrate, with or without appetizing substances, into the robot self-feeder was considered in this paper, to examine if this practice can improve and regularize the animal flow towards milking and feeding areas.

Material and Methods

The trial started in July and ended in October 2002 in the experimental barn of the Animal Production Research Institute in Cremona, with the co-operation of "Consorzio Agrario di Cremona" which provided the concentrate that was supplied by the robot self-feeder.

The AMS was installed inside the existing free-stall barn, which has a central feeding alley; on the opposite sides there were two feeding areas and two rows of cubicles. On one side there was the waiting area and the milking parlour; the AMS was installed on the opposite side. On the side of the AMS, cows could move from the feeding to the resting area passing through one-way gates; cows could move from the resting to the feeding area passing through the milking area. A small waiting area was near the milking box and the access was possible through a pre-selection gate, which directed to the feeding area the cows that had been milked less than 5 hs before; otherwise, the cows were directed to the milking unit. Once a day all the cows were fetched to the AMS and let to be milked automatically.

Forty Italian Friesian cows entered the trial divided in two groups of comparable age, stage of lactation, milk yield, and average number of accesses at the milking stall throughout two weeks before the trial start.

The feeding system for the robot stall consisted of two silos and two feed dispensers, so that it was possible to distribute at the same time two kinds of concentrate. The animals were fed the same total mixed ration (TMR) which was distributed *ad libitum* and was formulated to meet the nutrient requirements for the productive level of the cows. The concentrate at the robot self-feeder was supplied at the amount of 1 kg / cow / day.

The comparison was between the neutral and the treated concentrate. The neutral concentrate was formulated with about 50% of wheat bran and 50% of corn meal, whereas the 4 experimental feeds consisted of the same raw materials with the addition of flavouring and/or appetizing substances:

P1: "aroma". Neutral feed with a combination of aromatic substances with a gustatory dominance of fenugreek flavour. Added at 450 g/t

P2: "sweetener". Neutral feed with natural highly intensive sweetener. It has a long round mouth feeling and reminds a little touch of liquorice. Added at 500 g/t

P3: "aromatic sweetener". Neutral feed with P1 (150 g/t) + P2 (500 g/t)

P4: "taste modifier". Neutral feed with a combination of aromatic substances as well as gustatory substances. Strong liquorice taste with low flavour. Added at 500 g/t.

The experimental design was according to the method of the opposed groups and successive alternate periods. The 4 experimental periods lasted 3 weeks each one . Within each period, the first week was for the adaptation, with both group that fed the neutral concentrate, whereas during the second and the third week there was the alternate supply of the neutral and treated concentrate to the two experimental groups.

During the second and the third week of each experimental period, the following data were recorded: 1) average daily number of visits to the AMS area per cow; 2) average daily number of visits without milkings per cow (passages to the feeding lane); 3) average daily number of milking per cow; 4) interval between milkings; 5) milk yield.

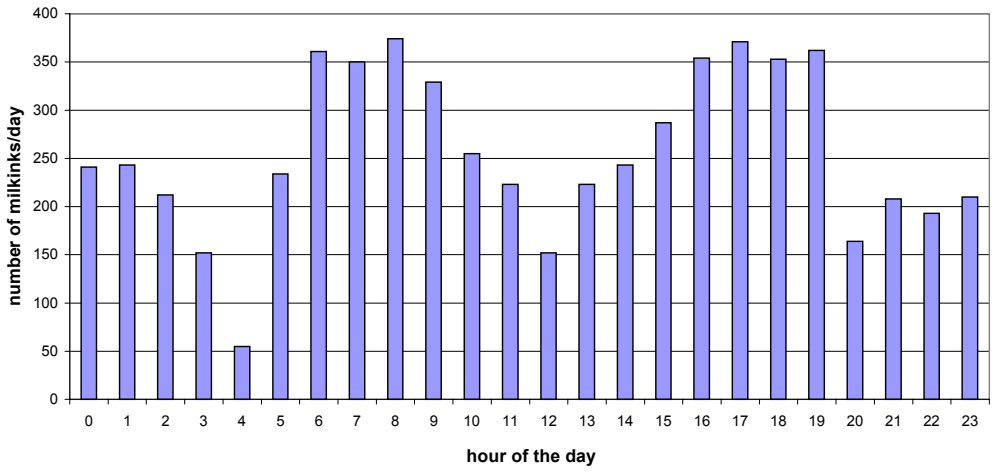
Data were analysed using the GLM procedure of SAS (1985), with the following model: $y_{ij} = \mu + t_i + g_j + \varepsilon_{ij}$

where y = dependent variable, μ = means, t_i = treatment effect (i=1,2), g_j = group effect (j=1,2) and ε_{ij} = residual error.

Results and Discussion

The milkings were more frequent in two different moments of the day, as reported in Figure 1: in the morning, when feed was distributed (06:00-09:00 h), and in the afternoon (16:00-19:00 h), when the stockman entered the barn for cleaning operations and drove the cows towards milking stall. These practices could be at the origin of the little differences in the recorded parameters (milk yield, milkings number, interval between milkings) between cows that received the neutral or the treated concentrate; however, the number of passages through the pre selection gate might assume much more importance for our evaluation.

Figure 1: Distribution of the milkings in 24 hours during the experiment

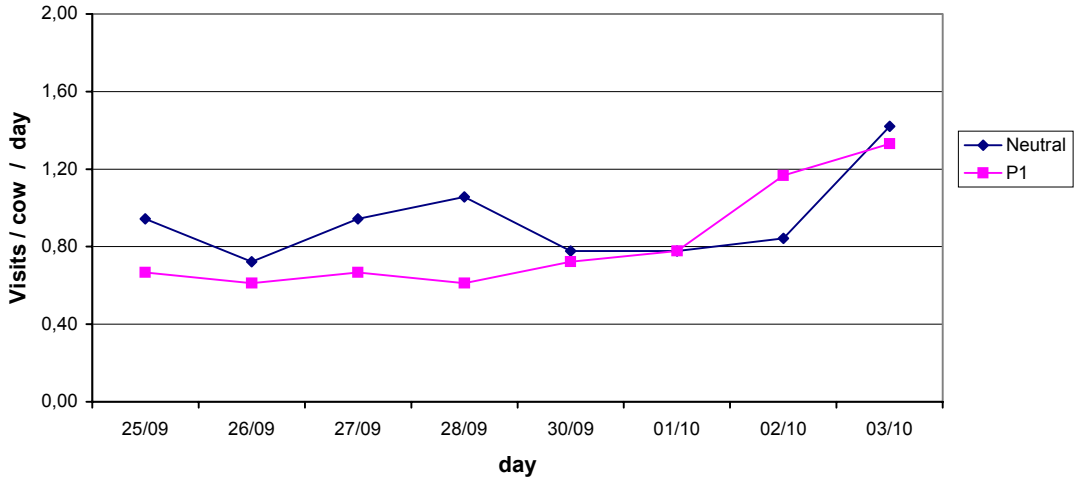


Treatment P1. There were no differences in daily milk yield, number of milking, and visits to the AMS area per cow between neutral concentrate and P1 (Table 1). Patterns of passages to the feeding areas were similar in both groups (Figure 2).

Table 1. Effect of P1 (aroma) on milk yield and milking measures.

	Neutral	P1	Standard error	*P*
Milk yield, kg/cow/day	25.6	25.7	1.44	NS
Visits to the AMS area/cow/day	3.88	3.75	0.18	NS
Milkings/cow/day	2.68	2.64	0.074	NS
Milking interval hh.mm.ss.	10.03.42	9.30.05	0.32.26	NS

Figure 2. Effect of P1 (aroma): visits without milking .

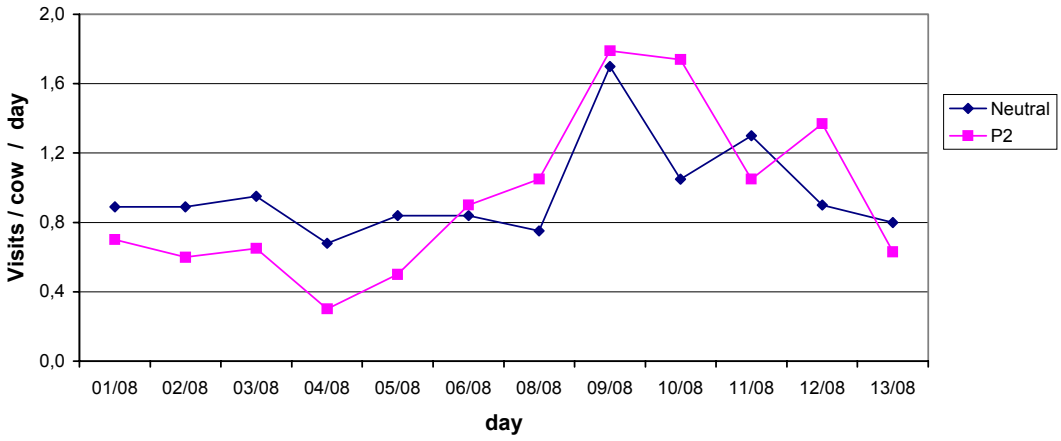


Treatment P2. There were no differences in milk yield , number of milkings and milking intervals between neutral product and P2 (Table 2). Patterns of milkings number with neutral and P2 products were similar (Figure 3).

Table 2. Effect of P2 (sweetener) on milk yield and milking measures.

	Neutral	P2	Standard error	*P*
Milk yield, kg/cow/day	26.1	26.1	1.28	NS
Visits to the AMS area/cow/day	3.58	3.53	0.16	NS
Milkings/cow/day	2.34	2.35	0.063	NS
Milking interval hh.mm.ss.	10.25.16	10.25.28	0.21.41	NS

Figure 3. Effect of P2 (sweetener): visits without milking .



Treatment P3. Table 3 reports milk yield, number of visits to the pre selection gate, milkings number, and interval between milkings when P3 was tested. Even if significant differences were not evidenced, there was a trend for an increased number of milkings in P3 group respect to the control (2.52 vs. 2.44; Figure 4); this trend was evident also when visits to the AMS area were considered (Figure 5). Number of passages through the pre selection gate was also higher when cows fed the P3 concentrate (4.43 vs. 3.88; P = 0.14). This might indicate the slight attractive effect evocated by P3 product (aromatic sweetener). This effect is more evident watching Figure 4, where the pattern of animal passages to the feeding area is reported, resulting always higher with P3 than with the neutral feed. The P3 product, obtained with sweetener substances combined with small quantities of aromatic substances, seemed to stimulate the animals to pass through the pre selection gate when compared to the neutral product.

Table 3. Effect of P3 (aromatic sweetener) on milk yield and milking measures.

	Neutral	P3	Standard error	*P*
Milk yield, kg/cow/day	24.1	23.7	1.36	NS
Visits to the AMS area/cow/day	3.88	4.43	0.26	0.14
Milkings/cow/day	2.44	2.52	0.067	NS
Milking interval hh.mm.ss.	9.59.48	10.27.44	0.32.00	NS

Figure 4. Effect of P3 (aromatic sweetener): milkings.

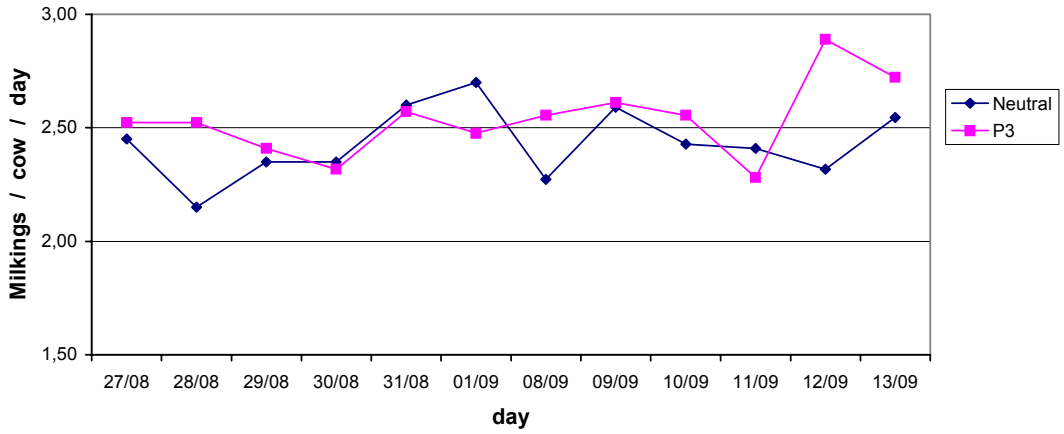
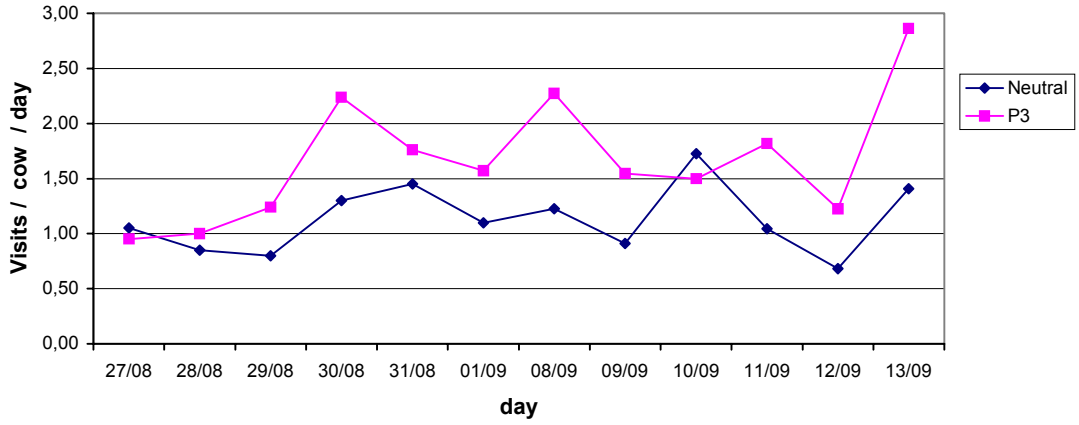


Figure 5. Effect of P3 (aromatic sweetener): visits without milking .

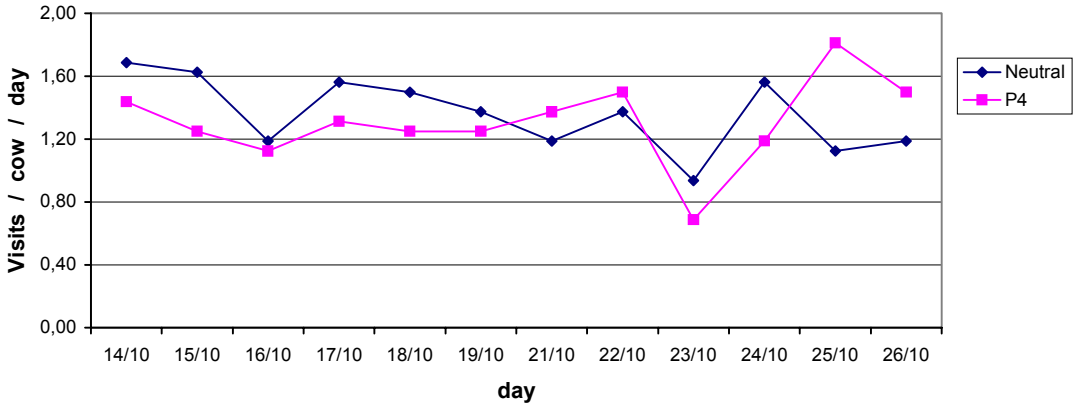


Treatment P4. There were no differences in daily milk yield, number of visits with milking, and visits per cow between the neutral product and P4 (Table 4). Pattern of visits was similar in both groups (Figure 6).

Table 4. Effect of P4 (taste modifier) on milk yield and milking measures.

	Neutral	P4	Standard error	*P*
Milk yield, kg/cow/day	25.9	25.6	1.60	NS
Visits to the AMS area/cow/day	4.12	3.93	0.23	NS
Milkings/cow/day	2.51	2.49	0.079	NS
Milking interval hh.mm.ss.	9.57.34	11.15.22	0.59.25	NS

Figure 6. Effect of P4 (taste modifier): visits without milking .



Conclusion

Generally, we concluded that appetizing and flavouring substances did not improve significantly the number of milking and the performances of the herd in this study.

We have to consider that animals were moved to the AMS once a day, which might hide differences.

Only the P3 product (sweetener + flavour) showed almost significant differences in daily voluntary visits per cow compared to the neutral feed.

When P3 was used, an increase in milking number could be noted compared to the neutral feed.

Further studies are needed to state if appetizing and flavouring substances can be used in order to avoid to fetch the cows to the AMS in the afternoon and to save labour.

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