Effect of concentrate feeding on milking frequency and milk yield in an automatic milking system

L. Migliorati¹, M. Speroni², S. Lolli³, F. Calza⁴

Istituto Sperimentale per la Zootecnia, Cremona, Italy

Corresponding author: Luciano Migliorati. Istituto Sperimentale per la Zootecnia. Via Porcellasco 7, 26100 Cremona, Italy – Tel: +39 0372 433029 – Fax +39 0372 435056 – Email: luciano.migliorati@isz.it.

INTRODUCTION – The application of Automatic Milking Systems (AMS) represents a substantial innovation in dairy cattle. The introduction of this new technology puts some questions about cow management. 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, allows: - to improve the number of milkings per cow, with positive effects on milk production; - to reduce average waiting time of cows before entering in milking stall, reducing animal stress; - to improve nutrient supply, with a better daily distribution of the feed intake; d) to increase the number of milkings per automatic milking unit. Possible causes of flow slowing down are: - lack of habit (particularly for new animals); - excessive cow density; - inadequate traffic system; - 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 suggested that animals go into the robot station more for food attraction than for milking need (Prescott et al., 1998). To minimize the lazy cow number, it is possible to increase the amount of concentrate in the robot self-feeder. Otherwise, if too high amounts of concentrate are considered detrimental, the use of appetizing and flavouring substances can be considered. The supply of low and high amount of concentrate, with or without flavoured and appetizing substances, into the robot self-feeder was considered in this paper, to evaluate if this practice can improve and regularize the animal flow towards milking and feeding areas.

MATERIAL AND METHODS – The trial started in April and ended in July 2004 in our experimental barn. Two AMS were installed in the existing free-stall barn, divided in two independent opposite sides by a central...
feeding lane. Cows could move from the feeding to the resting area passing through one-way gate; 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 h before; otherwise, the cows were directed to the milking unit. Cows were stimulated to move to the pre-selection gate at 06:00 in the morning when total mixed ration (TMR) was distributed, and at 16:00 in the afternoon during stockman’s cleaning operations. Twice a day at 09:00 and 17:00 only the cows with more than 12 h from previous milking were fetched to the AMS. The AMS feeding system consisted of two silos and two self-feeders, one for each side of the barn, so that it was possible to distribute the kind and the quantity of concentrate assigned to each treatment. Animals were fed corn silage (36%), alfalfa hay (13%), fescue hay (7%), protein supplement at 40% CP (16%), mix of corn flaked and corn meal (20%), cotton-seed (7%), mineral-vitamin premix (1%) on dry matter (DM) basis. The diet was formulated to meet nutrient requirements for a production of 28 kg of milk, and distributed ad libitum. Forty-four Italian Friesian cows entered the trial divided in four 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. Experimental design was 4*4 latin square with four groups and four periods and each of the four periods lasted three weeks. The first week was for the adaptation, whereas the second and the third week were experimental periods. The compared treatment was: high (H) and low (L) level of concentrate with addition (A) and no addition (C) of flavouring and appetizing substance. The assigned concentrate amount at the robot self-feeder was: 1 kg + 0.016 kg/cow/day per each kg of produced milk in low level (L), and 4 kg + 0.016 kg/cow/day per each kg of produced milk in high level (H), with or without the addition of flavouring and appetizing substances. The control concentrate (C) was formulated with 30% of corn meal, 18% soybean meal, 15% dehydrated sugar beet pulp, 18% corn gluten feed, 5% sunflower meal, 8% wheat middlings, 2.5% sugarcane molasses, 3% buffer and 0.5% mineral-vitamin premix; the experimental concentrate (A) consisted of the same raw materials with the addition of 150 g/t of a combination of aromatic substances with a gustatory dominance of fenugreek flavour and 500 g/t of natural highly intensive sweetener (aromatic+sweetener). It has a long round mouth feeling and reminds a little touch of liquorice. We used this product (aromatic+sweetener) because it was that which gave the most promising results among the flavouring and appetizing substances tested in a previous trial (Migliorati et al., 2003). During the trial, controls were carried out on: - concentrate fed in the milking box; - number of visits to the pre-selection gate; - interval between visits to the pre-selection gate; - average daily number of milkings per cow; - interval between milkings; - milk yield. Effects of treatment, cow in the group, and period were determined with ANOVA using the MIXED procedure of SAS (SAS Inst., Inc., Cary, NC). The cow was used as a random effect.

**RESULTS AND CONCLUSION** – Table 1 reports concentrate fed in the milking box, number of visits to the pre-selection gate, interval between visits to the pre-selection gate, milkings number, interval between milkings and milk yield.

*Concentrate fed in the milking box.* As expected, concentrate intake was significantly higher when cows were fed the H than L (P<0.001), while no differences were observed between A and C concentrate intake. This means that cows generally consumed all the concentrate distributed with all treatments.

*Number of visits to the pre-selection gate.* Number of visit to the pre-selection gate was significantly higher (P<0.001) when A was fed. This result showed a certain effect of the palatable concentrate in attracting cows to the milking area.

*Interval visits to the pre selection gate.* Interval between visits to pre-selection gate was lower when A was fed (P=0.001). Moreover, frequency distribution of interval length showed that a higher proportion of visits occurred after very short interval (<1 hour) with A (41 vs. 32%). Visits with an interval length >4 h were 39 and 45% with A and C respectively.

*Milking frequency.* There were no differences in number of milkings between treatments A and C.
Milking interval. There were no significant differences in milking interval between treatments A and C, even if the treatment C presented higher interval.

Milk yield. The milk yield did not show significant differences between A and C and between H and L treatments. However with A treatment, milk yield was 1 kg higher than with C treatment. Probably, the higher number of visits to the pre-selection gate observed with A treatment resulted in a higher number of visits to the TMR. This had a positive effect on milk yield under the same number of milkings. We concluded that cows consumed all the distributed A or C concentrate. Concentrate A attracted cows to the AMS area more than C concentrate, but it did not improve the milkings number. The higher proportion of short intervals between visits to the pre-selection gate when A was fed, together with the constraint of a minimum milking interval (5 h), can explain why the attractive effect didn’t result in a better cow flow towards AMS. However, the treatment A showed a slightly higher milk yield. The supply of different levels of concentrate did not modify significantly the controlled parameters.

Table 1. Effect of the concentrate amount (H: high; L: low) supplied in the milking unit; without (C) or with (A) addition of flavoured and appetizing substances on milk yield and milking measures.

| Concentrate Type | Amount | Thesis | A  | C  | P   | H  | L  | SE  | P       |
|------------------|--------|--------|----|----|-----|----|----|-----|---------|
| Concentrate fed in the milking box (kg/cow/day) | 2.55   | 2.50   | NS | 3.65| 1.4 | 0.007| P<0.001|
| Number of visits to the pre-selection gate (cow/day) | 6.60   | 5.61   | P<0.001| 5.95 | 6.26 | 0.369| NS     |
| Interval between visits to the pre-selection gate (hh.mm.ss) | 5.08.18| 5.51.16| P=0.001| 5.29.10| 5.30.54| 0.24.07| NS     |
| Milkings number (cow/day) | 2.50   | 2.53   | NS | 2.52 | 2.52 | 0.062| NS     |
| Milking interval (hh.mm.ss) | 9.52.18| 9.56.50| NS | 9.53.47| 9.55.22| 0.16.32| NS     |
| Milk yield, (kg/cow/day) | 27.90  | 26.90  | NS | 27.50| 27.20| 1.169| NS     |

ACKNOWLEDGEMENTS – Special thanks to Pancosma A.A. Company, supplier of additives used in the trials, to Mr. R. Bombardieri from Sevecom S.P.A., Italian Agents of Pancosma and to Consorzio Agrario di Cremona. Research financed by the Regione Lombardia.

REFERENCES – Harms, J., Wendl, G., Schön, H., 2002. Influence of cow traffic on milking and animal behaviour in a robotic milking system. In: Proceedings of First North American Conference on Robotic Milking, II 8-14. Migliorati, L., Schlegel, P., Speroni, M., Capelletti, M., Abeni, F., Pirlo, G., 2003. Use of flavouring and appetizing substances in an automatic milking system. 38° Simposio Internazionale di Zootecnia. Milk and Research. Lodi, 207-215. Pirlo, G., Abeni, F., Capelletti, M., Migliorati, L., Speroni, M., 2002. Crescono le certezze per il robot di mungitura. L’Informatore Agrario 29:33-38. Prescott, N.B., Mottram, TT., Webster, A.J.F., 1998. Relative motivations of dairy cows to be milked or fed in a Y-maze and an automatic milking system. Applied Animal Behaviour Science 57:23-33.