NUTRITION and HEALTH

Designing palatants for dairy cows in automated milking robots

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Palatants are used in the diet of dairy cows to encourage a higher feed intake, leading to an improved energy balance in early lactation, and higher milk yield during mid lactation. The important role of feed palatability in livestock animals, and particularly in some ruminants, is reflected in their sensitivity to the smell and taste of feed, which influences their feeding behaviour. New technology has enabled the use of palatants in automated milking systems, to provide an added incentive to dairy cows to visit the milking robot more often, increasing their milking frequency.

Higher productivity with automated milking systems

Automated milking systems (AMS) have been commercially available for more than 20 years, and are now gaining increasingly more interest from farmers. It is predicted that by 2025, up to 20-25% of dairy cows will be milked by AMS.

One of the major advantages of using AMS is the increased milking frequency, which is the main factor leading to higher productivity. Independently of the milking system used, an increase in milking frequency has been shown to result in higher milk yields (see figure 1). This observation was independent of the production levels. In addition, studies demonstrated that an increase in the frequency of milking during early lactation has a carry-over effect, leading to an improvement in the overall production efficiency of the cows (see figure 2).

Whereas conventional methods milk cows in groups at set times, automated systems depend on the voluntary movement of cows to the AMS. Therefore, the greater the voluntarily visits to the AMS, the higher the milk yields. However, the challenge lies in the low frequency of voluntary milking, and in finding effective incentives to increase their visits.

Designing the optimal palatant

Improving the palatability of feed at the AMS station by altering its taste and smell may encourage cows to repeatedly visit the AMS, increasing milking frequency and yield. Smell is an important incentive encouraging cows to approach the feed, and involves motivation and appetite. Taste is key to maintain feeding, and depends on palatability.

A three-part study evaluated the optimal palatant for AMS. The first part identified the ideal feed flavour to increase the frequency of voluntary milking. Part two evaluated the efficiency of taste modifiers to maintain continued feeding. In the final part, the optimal palatant was created by combining the most efficient flavour and taste modifier, and evaluated under farm conditions.

Figure 1: Milk yield is a function of milking frequecy

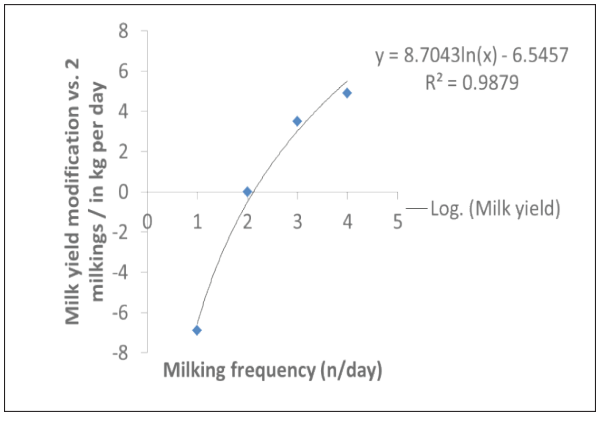
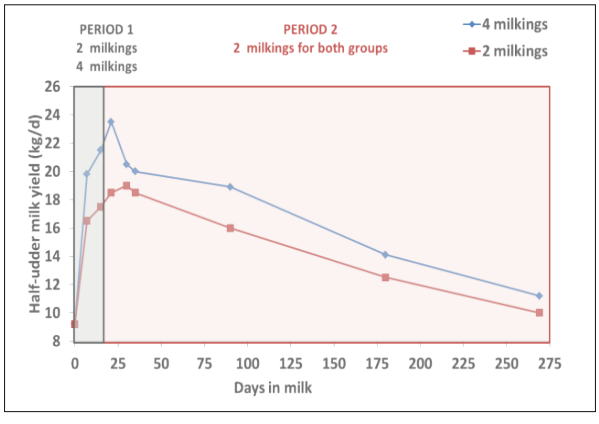


Figure 2. Increased milking gives higher milk yield



Part 1: The ideal flavour

A preference trial evaluated the preference of dairy cows for several different types of flavours. The test involved 16 lactating Holstein cows averaging 197 ± 32 days in milk (DIM), 1.9 ± 0.8 lactations, 27.8 ± 4.2 kg/d DMI, and 41.5 ± 7.4 kg/d milk yield. Cows were housed in a tie-still barn, and were offered 4 flavoured concentrate premixes (FCP) once a day for 6 consecutive days, 2 hours after the morning feeding. Each flavour was given in a volume of 1 kg, placed directly in front of the animal in plastic bins.

Seven distinct flavours were tested: vanilla, fenugreek, thyme, honey, orange, molasses, and anise. These test flavours were compared to a neutral-flavoured control feed, which was not their usual feed. The cows

Table 1: Effects of SUCRAM® on milk production variables in stage 1 cows

EFFECTS OF SUCRAM® ON MILK PRODUCTION VARIABLES OF LACTATION STAGE 1 COW

	CONTROL	SUCRAM®	Treatment *P* value	Parity *P* value	Treatment x Parity interaction *P* value
Milk yield (kg/d)	44.5	45.6	0.10	< 0.001	0.30
Fat %	3.67	3.78	0.003	< 0.001	0.50
Yield (kg/d)	1.62	1.71	0.003	< 0.001	0.30
Protein %	3.18	3.21	0.02	0.15	0.22
Yield (kg/d)	1.41	1.46	0.02	< 0.001	0.30
ECM (kg/d)	46.0	48.0	0.004	< 0.001	0.30

Figure 3. Evaluating flavour preference

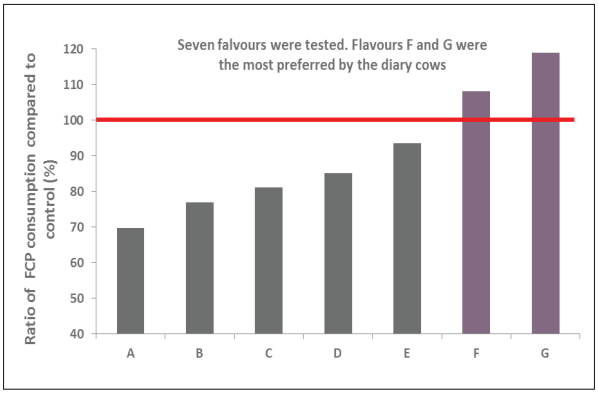
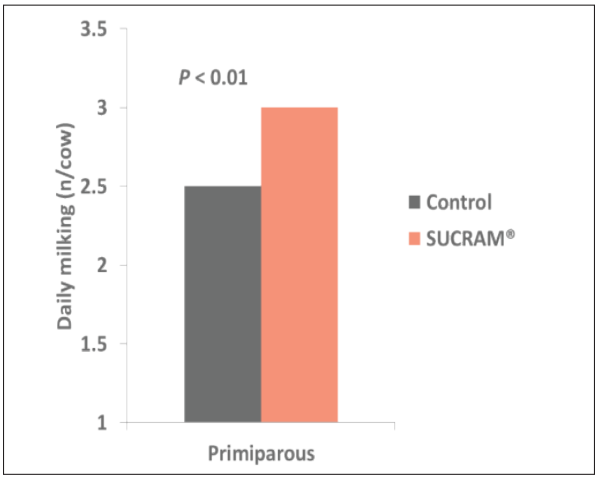


Figure 4. Milking frequency in primiparous cows with SUCRAM®



were not adapted to the flavours before the trial. To avoid any bias, flavour dosages were set to maintain similar flavour intensities. Flavour inclusion rates were between 250 – 300 g/t. The flavours and the positons in which they were placed, were randomized. The cows had access to the FCP for 5 minutes from the start of feeding. Eating times, consumed FCP, and consumption rates were recorded and analysed.

The trial successfully identified the specific flavours that were clearly preferred, which were associated with an increased consumption level of up to 19% compared to the control, and up to 50% compared to other flavours tested (see figure 3). There was no significant effect of the bin positions on feed consumption.

Part 2: Evaluation of high intensity sweeteners

In addition to the flavour and smell, taste is another crucial parameter. High intensity sweeteners have been shown to effectively improve the taste and feed palatability. The sweet taste is naturally preferred by animals, and is used as an integral palatability enhancer in most animal diets.

A trial was conducted to evaluate the effect of supplementing feed with the high intensity sweetener, SUCRAM® , during different production stages. During 8 weeks, 180 highly productive Holstein dairy cows of mixed parity were housed in a free stall pen and milked using AMS. Cows were grouped based on parity (primiparous or multiparous), and lactation stage (stage 1: < 99 DIM, and stage 2: > 100 DIM), and fed a control diet (CONTROL), or a control diet and SUCRAM® in a blend of distiller grains during milking at the AMS (SUCRAM®).

Interestingly, the response to SUCRAM® inclusion depended on the lactation stage. For cows in lactation stage 1 (DIM < 99 days), SUCRAM® significantly increased all milk production variables, including milk components and energy corrected milk (see table 1). For lactation stage 1 cows, the response to SUCRAM® treatment on milk production variables was not influenced by cow parity (absence of treatment x parity interaction).

The milking frequency in primiparous cows fed SUCRAM® in stage 1 cows (see figure 4), was significantly increased, leading to higher milk yield, demonstrating the benefits of SUCRAM® to improve milk production.

Part 3: The optimum palatant combination

MAGNASWEET® was scientifically developed to target and activate oral (smell) and lingual (taste) sensory receptors, to activate the nervous system and trigger an attraction and reward process.

A trial was held in Italy using 52 Friesian cows to evaluate MAGNASWEET® in AMS, using a changeover experimental design. The cows were divided into 2 treatments groups based on parity, DIM, milk yield, and the frequency of visits to the AMS. The cows were fed either a neutral concentrate or a concentrate containing MAGNASWEET®. The trial took place over 2 periods of 4 weeks each, including 1 week of adaptation and 3 weeks of treatment. The results (see figure 5) demonstrate that MAGNASWEET® inclusion in dairy cow feed resulted in a 4% higher milking frequency, and an increase in milk production of 0.8 kg/day.

Conclusion

In order to be economically efficient, automatic milking systems need to boost the voluntary milking frequency, to positively impact milking frequency and milk yield. Designing the right palatants by combining the optimal smell and taste, is a crucial contributing factor leading to the efficient use of AMS.

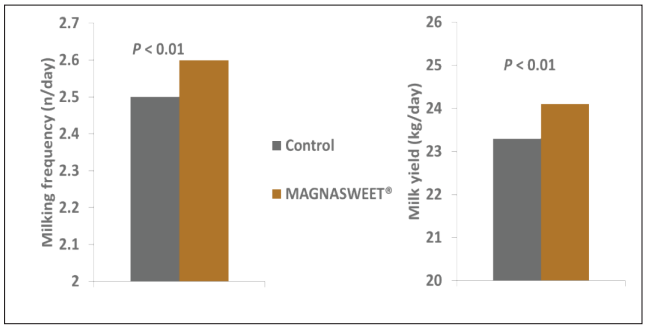


Figure 5. Milking frequency and milk yields with MAGNASWEET®

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