Agronomy Research **12**(1), 231–236, 2014

Fodder feeding peculiarities when introducing the VMS automatized cow milking system

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Abstract. The research concerns fodder distribution solutions for cows which are milked using the VMS robotised equipment produced by the company *DeLaval*. The research is conducted at the milking cow farm 'Līgotnes' of the Latvia University of Agriculture study and research farm 'Vecauce'. In the research, cattle-shed cows receive fodder in three different places: together with the basic feed mixture while eating at the feeding table, in the robotised milking stand and at the fodder feeding stations.

The research has stated that this feeding system is rational. Adding fodder to feed mixture (about 10% of its mass) is necessary as it improves the feed mixture taste qualities. Hence, it increases the consumption of this mixture and also the cow yield. If fodder is not added to the mixture, the productivity of highly productive cows deteriorates and can decrease by 10%. Moreover, we can add to basic feed mixture fodder prepared at the farm using the grains grown there. Usually, such fodder is cheaper than the bought one, and therefore decreases the prime cost of the milk.

Fodder is also fed also in the robotised cow milking stands as such an approach stimulates cows to visit the milking stands more frequently. But during the research we found that highly productive cows with the yield exceeding 30 kg per day do not manage to eat all the due fodder amount during milking. Therefore, fodder feeding stations are necessary for feeding of highly productive cows. They shall be placed after the sorting gates so that the cows that are not directed to milking by the automatic sorting system could visit the fodder stations. Moreover, the number of fodder feeding stations per one cow milking group should not be less than two.

Key words: feeding cows, fodder, AMS, fodder stations.

INTRODUCTION

Fodder is an important means of feeding with high energy concentration and good digestibility of nutritive stuffs. As a result, it is widely used for feeding of milking cows. But with introduction of automatic milking (AMS), fodder is also used as a peculiar stimulus for visiting milking stands. It is necessary as in the case of automatic milking cows must visit the milking stand themselves. But in any herd there are also 'lazy' cows that like to spend much time in the recreation area and not visit the AMS even if the interval till the next milking time is significantly exceeded (Laurs et al., 2008). Therefore, in case of robotised milking, a part of the total fodder amount is fed in the milking stand in order to stimulate cows to visit the AMS regularly (Latvietis et al., 2008).

Cows can receive the rest of the fodder amount with the basic feed mixture fed at the feeding table, but sometimes fodder is also served at specially organized fodder feeding stations. But the usage of such stations is connected to the necessity of an additional area and also costs (Latvietis & Priekulis, 2011).

Currently, literature does not specially describe the necessity of feeding fodder as a part of the feed mixture and at the fodder stations, therefore, the aim of our research was to find out the practical necessity of such feeding places (Nydegger & Bolli, 2009).

MATERIALS AND METHODS

For research, we used the data from the milking cow farm 'Līgotnes' of the LLU study and research farm 'Vecauce', where in a separate section automatized milking is introduced using two VMS milking stands produced by the company *DeLaval* (Fig 1).

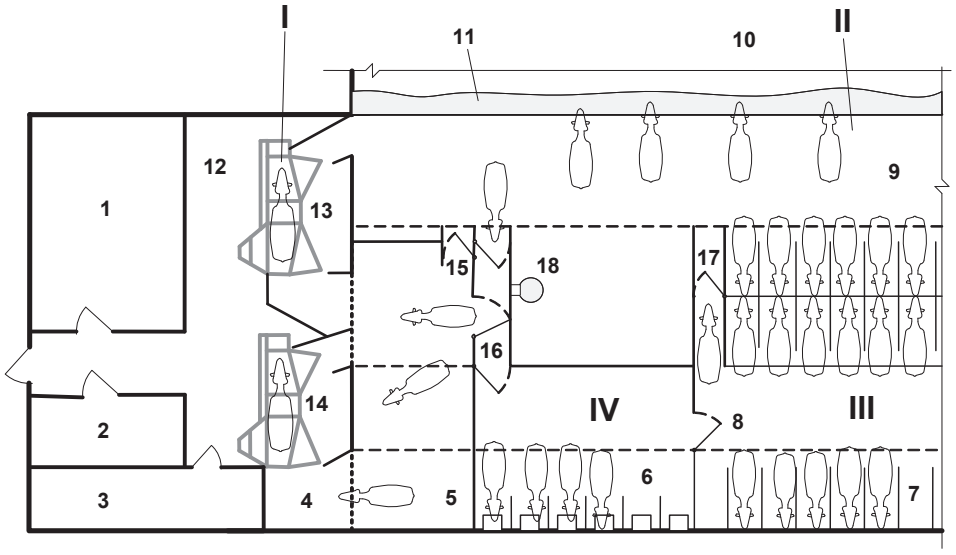

Figure 1. Cattle-shed section plan at the LLU study and research farm Vecauce, where the AMS cow milking is introduced: I – milking area; II – feed mixture feeding area; III – recreation area; IV – combined fodder feeding area; 1 – milk room; 2 – computer room; 3 – technical corridor; 4 – milking anteroom; 5 – pre-milking area; 6 – combined fodder feeding stands; 7 – recreation boxes; 8 – one-way gates; 9 – manure passage; 10 – feed table; 11 – fed basic feed mixture; 12 – corridor; 13, 14 – AMS; 15 – cow after-sorting gates; 16 – cows before-sorting gates; 17 – transition corridor with one-way gates; 18 – rotating combs for treatment of cows bodies.

In this case, cows were fed in three places – at the feed table, during milking and at the fodder feeding stations. The basic feed mixture fed at the feed table included medicine and maize silage, perennial herbs hay and the fodder produced at the farm (rolled barley grains, common salt and different admixtures), and cows could eat an unlimited amount of this mixture. In turn, during milking and at the feed stations, cows

were fed bought fodder the distribution of which was conducted with a herd management system.

Research was conducted in two cycles. During the first cycle, we clarified the necessity of including fodder into feed mixture, as there was the hypothesis that the fodder amount necessary for cows could be fed in milking stands and at feed stations not including it into the mixture as this could improve the frequency of visiting the AMS.

During the second cycle, we clarified the possibility of cows feeding at the feed table and during milking refusing to use the feed stations.

The length of the first research cycle was 10 weeks. Changes in feeding took place from the 5th week but the necessary data were summarized about the first and the last four weeks of the research cycle, including into the interval of two other weeks. Information on yields and visiting the AMS was obtained from the data accumulated in the herd management system. In addition, cows were grouped according to their yield per day, separately grouping animals with the yield below 15, 15–25, 25–35, 35–45 and above 45 kg per day. Additionally, feed cost were calculated per one kilo of milk using for the calculated cost of the feed produced at the farm and the bought fodder prices (Brade et al., 2008).

The second research cycle was conducted one year later and its duration was 2 weeks. During that, cows were fed like in the first period of the first research cycle and were also divided into analogical yield groups. Using the herd management system, we found the time spent by the cows with different productivity in the robotised milking stand, and also the average number of milking times per day.

The maximum fodder amount that can be received by each animal of a separate productivity group was calculated using formula

$$M_{s.i} = M_{m.i} + v_s \cdot n_{s.i} \cdot t_{s.i}, \quad (1)$$

where: $M_{s.i}$ – maximum fodder amount that can be received by each cow of i productivity group, kg day^{-1}; $M_{m.i}$ – fodder amount eaten by i-group cow with feed mixture, kg day^{-1}; v_s – average fodder consumption speed, kg min^{-1}. According to the literature data (Latvietis et al., 2008), the average fodder consumption speed for a cow is 0.33 kg min^{-1}; $n_{s.i}$ – average number of milking times for i cow group animals, times per day; $t_{s.i}$ – average length of one milking time for i-group cows, min.

For the cows of a corresponding yield group to be able to eat the necessary fodder amount, the following inequality shall be in force

$$M_{s.i} \geq M_o, \quad (2)$$

where M_o – normative fodder amount for one cow of i yield group, kg day^{-1}.

RESULTS AND DISCUSSION

Information on the frequency of visiting the AMS and on the yield for the cows of different productivity depending on fodder adding to the mixture is summarized in Table 1.

Table 1. The effect of the cow feeding solution on the frequency of visiting the AMS and changes in the yield (Validity 95%)

Trial period	Productivity group, kg day^{-1}	Average frequency of visits to AMS, times day^{-1}	Average yield, kg day^{-1}
Before exclusion of fodder from basic feed mixture	below 15	2.05	13.01
	16–25	2.45	21.04
	26–35	3.04	30.05
	above 36	3.10	39.89
After exclusion of fodder from basic feed mixture	below 15	2.10	13.22
	16–25	2.68	20.86
	26–35	3.12	28.88
	above 36	4.00	38.25

The information received when processing the data accumulated in the cow herd management system is seen in Table 2.

Table 2. The average duration of milking one cow and the number of milking times per day depending on the yield (Validity 95%)

Productivity group, kg day^{-1}	Average duration of one milking time, min	Average number of milking times for one cow, per day
below 15	8.20	1.60
16–25	8.36	2.32
26–35	8.52	2.62
36–45	8.90	3.20
above 46	9.12	3.63

In order to obtain the data with the validity of 95% that is depicted in Table 1 and Table 2, a statistical analysis was carried out (Arhipova, 2003). From the table we can see that the time spent by cows in the milking stand is within 8.2 to 9.12 minutes and it depends on the yield. The higher the yield of the cow per day, the longer is the duration of one milking time. Moreover, more productive cows also visit the milking stand more frequently. For example, if the average yield is only 10 kg day^{-1}, these cows are milked 1.6 times per day, but the cows with the average yield of 50 kg day^{-1} visit the milking stand 3.63 times per day.

Information on the amount of fodder necessary for cows depending on the yield and the practically available fodder amount that the animals can receive with the feed mixture and visiting the milking stand is summarized on Fig. 2.

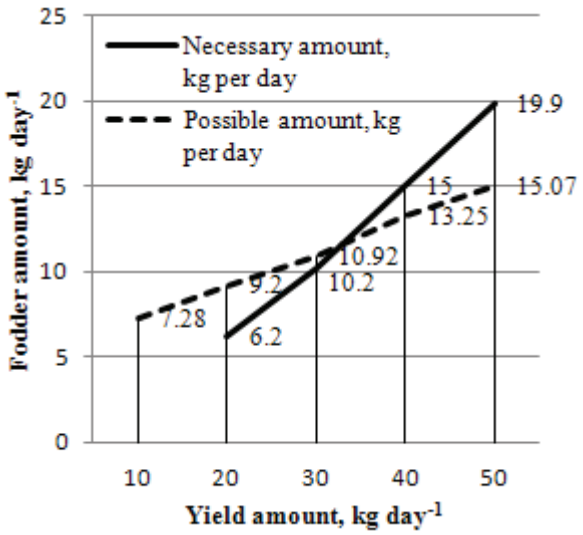

Figure 2. Fodder amount necessary for cows of different productivity and the practically received fodder amount if fodder is included into the feed mixture (~10% of its mass) (Osītis, 2005) and additionally fed in the milking stands, but fodder stations are not used.

From the figure, we can see that the cows with the bigger yield receive the bigger fodder amount. It happens because these cows spend more time in the milking stand and also visits it more often. Moreover, they eat a larger amount of the feed mixture, which includes fodder. But this fodder amount increase is not sufficient for highly productive cows, the yield of which exceeds 30 kg per day (7,000–8,000 kg year^{-1}), as they need 15 and more kg of fodder per day. Hence, it is expedient to also use fodder feeding stations for feeding of these cows, as they can receive the lacking fodder amount there.

In addition, there is also another solution to the problem – to increase the fodder amount added to the feed mixture. But then obesity of less productive cows is possible. Therefore, in this case, all cows milked by robotised milking equipment shall be grouped according to the yield level, not allowing the difference of more than 20 kg a day in the yield of the cows included in one group.

CONCLUSIONS

1. If cows are milked using the VMS robotised milking equipment produced by the *DeLaval* Company, the duration of one milking time and the number of visits to milking stands per day depends on the yield. The milking duration of the cows with the average yield of 10 kg a day is 8.2 minutes, but the milking duration of the cows with the average yield of 50 kg day^{-1} – 9.12 minutes. Moreover, the numbers of visits to milking stands for the cows of corresponding yields are 1.6 and 3.6 times per day. Therefore, for more productive cows it is possible to eat a larger amount fodder during milking per one day.

2. The most productive cows also consume the greatest amount of feed mixture, which contains fodder, and therefore can receive the largest total amount of fodder via this feed mixture.

3. If the average cow yield does not exceed 30 kg day^{-1}, cows can receive the necessary amount of fodder with the basic feed mixture, and also during milking, but if the yield is more than 30 kg day^{-1}, the fodder amount received in the abovementioned ways is not sufficient and additional cow feeding is desirable using fodder feeding stations.

ACKNOWLEDGEMENTS: This work was developed thanks to the project 'Support for Implementation of Master Studies at the LUA' financed by the European Social Fund. Agreement No. 2011/0020/1DP/1.1.2.1.1/11/IPIA/VIAA/011.

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