ECONOMIC EFFECTS RELATED TO MASTITIS IN DAIRY COW PRODUCTION

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Abstract: *The mastitis of high producing cows causes the largest economic and production loss. Due to the disease, the amount of produced milk will reduce. This milk cannot be sold as food. Besides the milk loss, additional losses such as cost of treatment and higher labour demand also occur. It is commonly noticed that one of the main reasons of culling is the unfavorable mastitis status of the herds. In practice there are many ways of reducing mastitis, but these are mostly in the direction of treatment rather than prevention. Providing favourable environmental conditions for cattle is an essential part of prevention. This research is based on impact analysis of newly developed milking system on milk quality parameters (before and after the installation). Data were collected at Pilot Farm of University of Szeged Faculty of Agriculture.*
In August 2016, Surepulse system inserts was installed equipped with pulsation adjustments. On March 2017 Calf 35 system was installed. During this period comprehensive data were collected for teat scores and SCC. The aim of the study was to examine the impact of Surepulse inserts, liners and Calf 35 system on SCC and milk production from viewpoint of economic efficiency.

***Key words**: dairy cow economy, SCC, milk yied, milking system*

INTRODUCTION

„To be profitable, dairy producers need cows that calve easily, produce large quantities of high quality milk, and are healthy, fertile and long lived" (Seykora, 2014). In the dairy cattle breeding the longevity of cows and reasons for culling are serious research problems (Horvath et al., 2017). In constant conditions of herd size, replacement rates are reduced and higher profitability of heifers is obtained by increasing longevity of female cows which would lead to profitability of the dairy cattle enterprise (Berry et at., 2005). Longevity, or lifespan of dairy cattle, is an economically important trait for dairy farmers because increased longevity helps to increase profitability (Van Pelt et al., 2015). Culling can be voluntary or involuntary. In the voluntary culling scenario of dairy cows, the farmer has complete freedom to choose or cull the cows that would lead to growth of farmer profit (Mohammadi and Sedighi, 2009). There is a very narrow freedom in the involuntary culling scenario for breeders; however, most of the time, it is necessary to cull animals from the herd (e.g. due to infectious diseases) which could almost wipe off a breeder's freedom of choice (Ghaderi-Zefrehei et al., 2016).

Mastitis is an endemic disease that is considered to be one of the most frequent and costly diseases in the dairy industry (Halasa et al., 2007). To assess the direct economic impact of mastitis, costs (i.e. extra resource use) and losses (i.e. reduced revenues) have to be aggregated (Seegers et al, 2003). Herd and population somatic cell count are related to the inflammatory process in individual cows but much more reflect the udder health status of the herd and the quality of the raw milk in the herd and the population (Schukken et al, 2003). The concentration of somatic cells, commonly known as somatic cell count (SCC), is the most widely used measure of raw milk quality (Banga et al, 2014). Dairy producers experience serious economic loss as a result of high somatic cell counts (SCC). Mastitis disease causes the highest veterinarian costs on dairy farms (Geary et al., 2012). A recent research (Hand et al., 2012) has revealed the link between mastitis and milk loss. Other studies (Miller et al., 2004) examined test-day milk yield loss considering one cattle as basis. These results revealed that the amount of expected milk yield loss could be altered by SCC and herd management. According to Dürr et al., (2008), milk losses per unit increase in LnSCC varied from 0.55 to 0.84 kg/day in first lactation Ayrshires, from 0.33 to 0.55 kg/day in first lactation Holsteins, from 0.74 to 2.45 kg/day in adult Ayrshires and from 0.77 to 1.78 kg/day in adult Holsteins. Hand et al., (2012) predicted that clinical mastitis in the first 30 days of lactation appeared with 28% of the total cost of mastitis regarding estimated milk yield loss. Findings presented that test day above 100 000 SCC/ml resulted in increasing daily milk yield losses. Financial value was associated to each estimated coefficient in regression analysis. The largest losses were found above 100 000 SCC. Based on this research producers have the opportunity to investigate tradeoffs and calculate or predict reasonable impacts of mastitis bywhich early detection of this disease is easier. However, SCC can be influenced by various parameters such as breed type, individual, environmental factors from which milking technology has the highest importance. Milking management practices can also affect teat health. Poor milking machine maintenance such as uneven pulsation or high vacuum pressure can reduce overall teat health (Hillerton et al., 2002). Variance analysis of Bhutto et al., (2008) revealed that quarter somatic cell count has influence on mammary infection and udder shape and teat-end lesions.

MATERIALS AND METHODS

Observations were made at pilot dairy farm of University of Szeged, Faculty of Agriculture. Alltogether 50 dairy cattles and their replacement heifers are kept on the farm. There are two milkings daily in the herringbone milking parlour equipped with 2x4 milking points. There is no automatic cluster remover in the milking house. Till 2016 commonly used milking cluster was in operation at this farm. In August 2016, Surepulse system inserts were installed as well as equipped with pulsation adjustments. On March 2017 Calf35 system was installed. During this period comprehensive data were collected for teat scores and SCC. The aim of the study was to examine the impact of Surepulse inserts, liners and Calf35 system on SCC and milk production from viewpoint of economic efficiency. Calf35 employs revolutionary technology, following pressure changes by the second and adds compensatory pressure into the pulsation chamber in order that the milking machine almost emulates a calf. The milk line now has one purpose: carrying away the milk at a lower vacuum, which is more in keeping with nature's vacuum of 35kPa (https://surepulsedairy.com/static/doc/Calf-35.pdf). The aim of this system is to milk the cows in a natural way. The vacuum is needed for milking. But it can cause problems as well.

The aim of this study was to compare the impact of commonly used milking cluster (System A) on milk production and SCC with Calf35 system (System B). Further goal was to determine the financial value of milk, which can not be sold as for human consumption. 929 test day (TD) records were taken during testing period between January 2015 and March 2018). From these 574 records were taken before Calf35 and 355 were collected after the system was established.

The statistical analyses were performed using SPSS 18.0 for Windows. The data were tested by the non linear regression using the Wood incomplete gamma function (Wood, 1967) with the following equation:

$Y_t=at^b exp^{-ct}$.

and

$Y_{t'}=a't^{b'} exp^{-ct'}$.

where Y_t is the average daily milk yield in the t month of lactation, *a* is the initial milk yield after calving, *b* is the ascending slope parameter up to the peak yield, and *c* is the descending slope parameter.

and

where $Y_{t'}$ is the average SCC in the t month of lactation, *a'* is the initial SCC after calving, *b'* is the ascending slope parameter up to the peak of lactation, and *c'* is the descending slope parameter.

The differences between the milk yield of the BCS*c* groups were tested by analysis of variance (One-Way ANOVA). The means were compared by Duncan's multiple range test based on the 0.05 level of probability.

RESEARCH RESULTS

In the first stage of the investigation period cows milked from two different milking systems were compared in order to determine their milk yield amount (kg). These results can be seen in Fig 1. Production data of the two systems can be seen in Table 1. System A had 601 test day data and 427 data were collected in case of System B. There was no significant difference between in case of daily milk yield. Minimum and maximum values were very similar. However SCC (1000xcells/ml) was 211 in case of System B, which was lower than in System A, where this value was 427. Logaritmic scale of SCC was applied in statistics in order to achieve more homogenous values. After this analysis B System presented more favourable parameters as well.

Table 1.

Descriptive statistics of test day records including milk yield, SCC and SCC log associated with System A and B

		N	Mean	Std. Deviation	Minimum	Maximum
Milk Yield (kg)	System A	601	29.66	9.3	5.6	56.2
	System B	427	29.64	9.6	5.4	56.4
SCC (1000xcells/ml)	System A	601	285	647	0	6304
	System B	427	211	718	0	9995
SCC_{log}	System A	601	5.11	0.58	3.48	6.80
	System B	427	4.91	0.59	3.60	7.00

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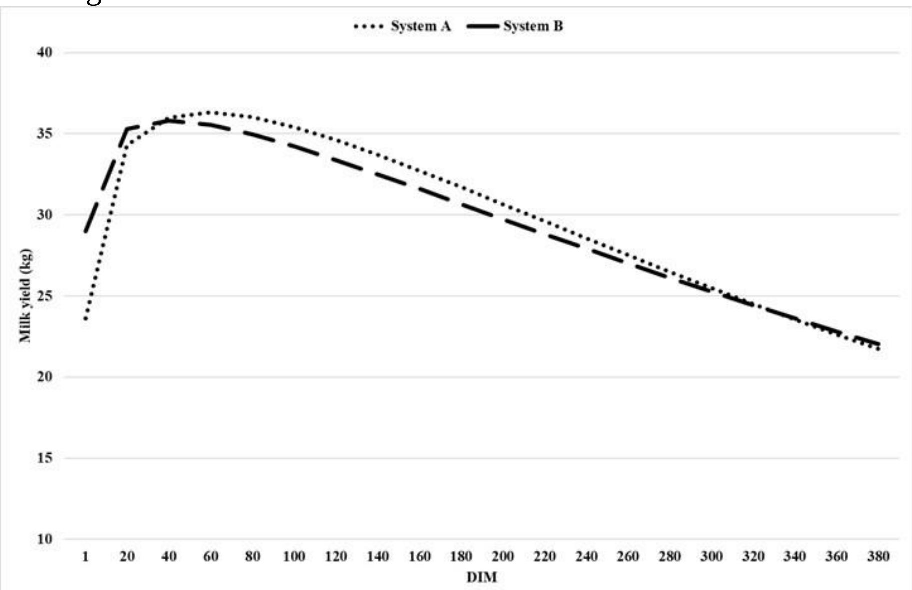

Figure 1. Lactation curve of the milked cows of the two system

Test day milk in System A and Sytem B varied similarely from 22 to 36 kg. Significant difference in milk production could only be experienced in the first 20 days of lactation. During this interval of examination period readapted clusters did not have impact on milk yield.

As SCC determines udder health status and profitability, rate of SCC was examined as well (Table 2). In case of System B amount (%) of cows with high level of SCC(SCC>400.000 cells/ml) was significantly lower compared to System A. These findings really proved the positive impact of Calf35 on udder health status.

Table 2

Rate of monthly average SCC tests in the two systems

	System A	System B
SCC<400.000 cells/ml	83.7%	90.6%
SCC≥400.000 cells/ml	16.3%	9.4%

Figure 2 presents the curves of SCC of the two systems. Results outstandingly show the positive impact of Calf35 system on SCC in this case as well. During total lactation period there was significant difference between SCC of cows milked by the two systems.

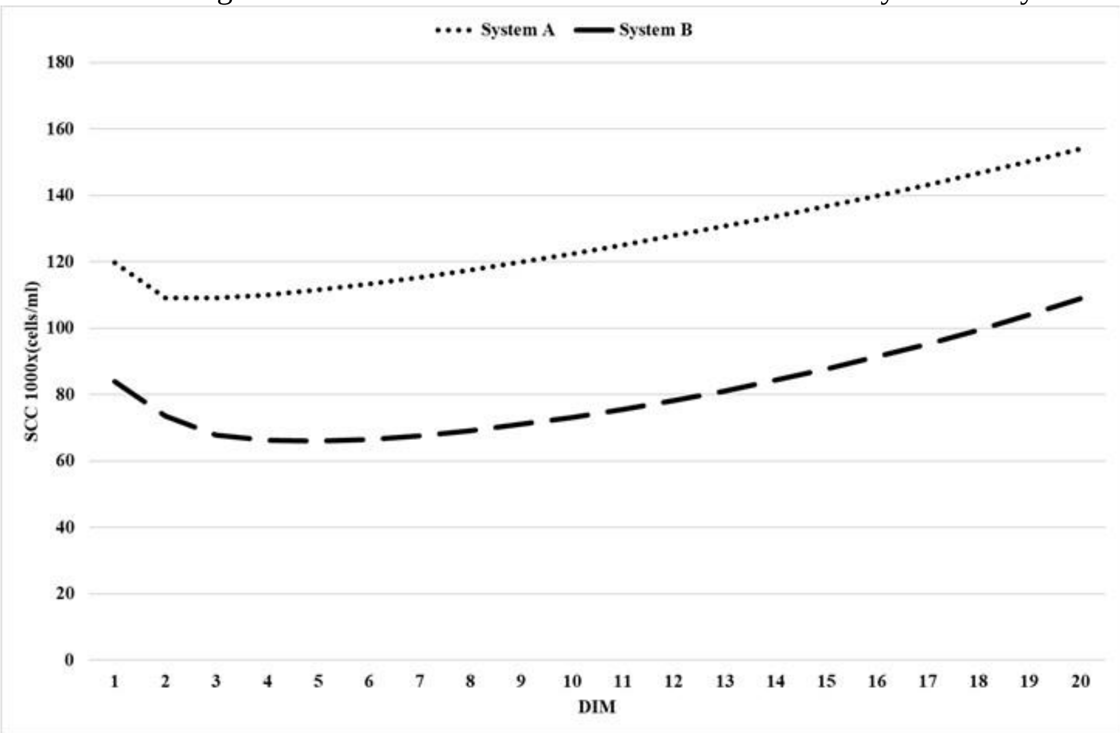

Figure 2. SCC curve of the milked cows of the two systems

Finally profitability of the two systems could be analysed considering commercialised milk amount, which is the most important value for the producers. Data of Table 3 presents the sold milk in System B was 26.06 kg/cow. In case of System A this value was only 21.45 kg/cow.

Table 3.

An example for monthly commercialised milk and its associated test day parameters

Examination period	N	Commercialised milk/month	Average commercialised milk /day	Average commercialised milk /cow	Average test day milk /cow	Average test day SCC /cow
April 2016 from System A	37	23806	794	21.45	29.59	418.000
April 2018 from System B	39	30494	1016	26.06	31.14	267.000

In these two periods (April 2016 and April 2018) data of test day SCC were outstandingly different considering the two systems. Based on the results the SCC that seems to be one of the most significant profit driver. Thanks to the Calf35 system the average per cow revenue from milk rose by 1.38 Euros/day. In the pilot farm what we examined 50 cows from which 37-39 are permanently milked. They can produce 6,450 Euros/year extra cash flow. The transformation of the milking system costs 48,000 Euros at the farm examined. Taking into account all above data as well as the discounted value of cash flow the investment can return in 8.97 years.

CONCLUSIONS

Low milk quality of dairy cows usually translates to economic losses. The SCC can affect profitability indirectly through culling as well as lost days in milk due to early drying off and directly through factors like treatment for udder infection and penalties imposed on milk with high SCC. Two milking systems were compared in this study focusing on the quantity of milk production, SCC and profitability. Either milking system was a commonly used version. The other system was a readapted technology, which is a brand-new approach in milking technology.

Based on statistics, there was no significant difference between milk yield of the two applied milking systems. However in SCC, there was remarkable positive impact of Calf35 system on udder health. Therefore the quantity of marketed milk can increase by the use of the new system. Results indicated that efforts to reduce bulk milk SCC resulted in substantial extra milk revenues. Seeing the data of the farm examined as well as considering the rentability characteristics of the installation it can be concluded that Calf35 investment can be paid back within nine years.

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