



Agricultural Economics

Effect of clinical mastitis at Holstein-Friesian cows on the farm economic efficiency

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Abstract. A study was conducted on the effect of clinical mastitis at Holstein-Friesian cows on the economic performance of dairy farms with different capacity. The study included three high-capacity farms in Bulgaria. The cows in all three farms are free-stall reared (freely in groups) and fed total mixed rations (TMR), in accordance with the animals' milk yields, with milking performed at a milking parlour. In each farm, the cows were separated into two groups – ones affected by clinical mastitis and healthy cows throughout the entire 305-day lactation period. The results from the study indicated that dairy capacity was high for both groups, with 7567.5 kg for the healthy cows during the 305-day period, and 7429.7 kg for the afflicted ones. The fat content of milk from healthy cows was 3.5% with 3.24% milk protein, with the values being 3.43% and 3.18%, respectively, for the afflicted cows. The cows with mastitis in the three studied farms exhibited lowered economic results. Profit from the healthy cows was higher, by 8.4% in the third farm up to 21.2% for the second farm, compared to the results for the affected cows. Cost-efficiency is also higher for the healthy cows, and the production cost of 1 kg of milk was lower, which was due to the higher marketing of milk for processing and the better purchase price. Apart from the worse economic performance of the cows affected by clinical mastitis, their productive longevity and total lifetime utilisation registered at the time of culling was reduced from 8.2% for the second up to 12.6% for the first farm.

Keywords: cost-efficiency, dairy cows, fat content, milk protein, milk yield, production cost, profit

Introduction

Among all technological factors, one of the most important is the health status of dairy cows, which affects the quantity and quality of produced milk, their productive longevity, and hence – cost efficiency. Mastitis is one of the most common illnesses in dairy cows (Bigras-Poulin et al., 1990; Rajala and Gröhn, 1998), which leads to considerable losses for the cattle farmers. The unfavourable economic effect of mastitis is due to direct losses from reduced milk productivity, increased expenses for medication, labour, increased milking time, deterioration in the overall health in case of comorbidities (Leseouret and Coulon, 1994; Halasa et al., 2007; Cha et al., 2011; Penev et al., 2012; Penev, 2013), earlier culling of the animals (Gröhn et al., 2005), changes in the milk content in terms of milk fats and protein, as well as an increased somatic cell count, with subsequent restructurings by dairy producers (Kudi et al., 2009). According to Edmondson (2004), the minimum losses to the farms due to mastitis, only due to the increased somatic cell count in the milk, amounted to £2 per cow per year, while Esslemont (2002) stated that total losses (direct and indirect) are no less than £150 per cow per year.

According to Buscom and Young (1998), mastitis is the main reason for culling in Holstein-Friesian cows with milk yields below 10,500 kg. Based on the source of the infection and the means of spreading, mastitis in cows can be divided

into two primary groups: mastitis caused by the environment, and infectious mastitis (Makovek and Ruegg, 2003; Kudi et al., 2009). The occurrence of the first group of mastitis is affected to a great extent by the components of the microclimate, while the second is affected by infected cows that spread the infection agent throughout the herd via infected milk.

In the last 10-15 years, in Bulgaria new farms for free-stall rearing of highly productive dairy cows were created. One of the main factors influencing their economic efficiency is mastitis in cows. The challenge presented is to find the balance between excellent cow comfort and manageable cow cleanliness as a main precondition for cow health protection (Cook, 2009). The goal of the present study is to establish the effect of clinical mastitis of Holstein-Friesian cows, raised in free-stall barns conditions on the economic efficiency results of high-capacity farms.

Material and methods

The study encompassed 300 Holstein-Friesian cows bred (including 181 healthy and 119 cows diagnosed with clinical mastitis) in three high-capacity farms in Bulgaria during the 2014-2015 period. With respect to farms, the number of healthy and diseased cows was as follows:

- Farm 1: 51 healthy cows and 49 cows with clinical mastitis;

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- Farm 2: 72 healthy cows and 28 cows with clinical mastitis;
- Farm 3: 58 healthy cows and 42 cows with clinical mastitis.

The cows in all three farms were kept free-stall and fed total mixed rations (TMR), in accordance with their milk yield, with milking performed in a milking parlour. The cows were housed in barns throughout the whole year. In all of the farms, our study included only cows without any other illnesses beside mastitis (clinical and subclinical - caused by the environment), as well as healthy animals. Infectious mastitis was not found in the examined farms due to the daily prevention measures. On these grounds, the cows were divided into two categories depending on their health status – healthy cows, and cows affected only by mastitis.

The data on the milk yield and the respective fat and milk protein content were obtained from the official control inspections of the studied herds. The study included data for a standard lactation ranging from 240 to 305 days.

Table 1. Average values of yield parameters for 305-day lactation, depending on the cows' health status

Health status	Number of animals	Milk yield, kg	Fats, %	Protein, %
Healthy cows	181	7567.51±122.56	3.50±0.0022*	3.24±0.007***
Cows affected only by mastitis	119	7429.68±148.19	3.43±0.025*	3.19±0.012***

*p<0.005; **p<0.01; ***p<0.001

Statistically significant differences were observed in the two main parameters related to the milk content for a 305-day lactation – percentage of fats (p<0.05) and protein (p<0.001). The cows affected by mastitis exhibited lower values for both parameters.

Rajala-Schultz et al. (1999) reported results similar to ours, with their estimated loss of milk due to mastitis ranging from 110 to 552 kg for a 305-day lactation. The large variation found by the authors was explained with the differences in the order of lactation that the cows were in.

During the present study, it was established that the number of mastitis cows varied from 28 for the second farm up to 49 in the first farm (Figure 1). These results are closed to the results found by other authors (Rahman et al., 2009), which established that mastitis was a major problem in contemporary cattle farming, and also dependent on the complex conditions at the individual farm. According to the data of Bascom and Young (1998), mastitis was the cause for 15% annual culling rate of cows. Mastitis conditions ranked second among the causes for cow culling due to udder damage, immediately after infertility, which accounted for 20% annual culling.

Our study found out that 12.6% of the cows were culled on Farm 1 due to mastitis (Figure 2). This percentage was considerably lower on Farm 2 – 8.2%, and on Farm 3 - 10.4%. The results obtained, even though they were lower for the studied farms than what was observed by Baccam and Young (1998), indicated that mastitis, apart from causing direct and indirect losses for the farms, was also a major cause for reducing the productive longevity and lifetime utilisation of the cows.

It is evident from the data presented in Table 2 that the differences in income per animal were significant, as milk cannot be vended to milk processing ventures for 2-3 days

The collected data were processed with the respective modules of the STATISTICA 6 software package, and cost-efficiency was established through the commonly used methods.

Results and discussion

Table 1 presents the average values of the examined parameters for a 305-day lactation period. It is apparent from the results that healthy cows have a slightly higher milk yield for the determined lactation period – 7567.5 kg, compared to the cows affected by clinical mastitis during lactation – 7429.7 kg, or a difference of 137.8 kg of milk, which was minimal and insignificant (p>0.05). The data indicated that clinical mastitis did not have a notable effect on the quantity of milk, which was explained by the fact that it usually occurred in high-yield cows.

after antibiotic treatment, but is usually used to feed the calves. More significant differences were found in the expenses, which are increased by 8.2% in the ill animals, mostly due to treatment expenses, which are 2.2 times greater than they were for healthy animals.

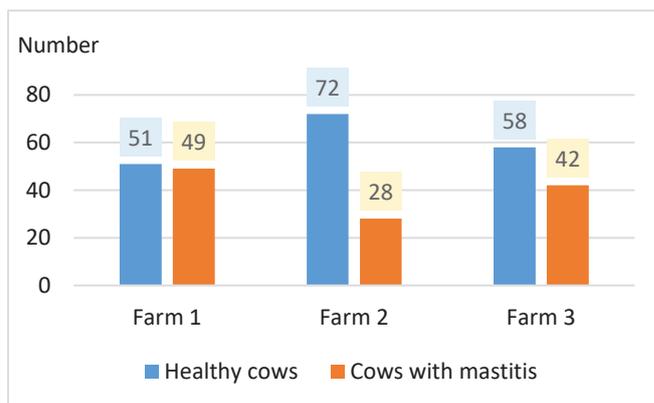


Figure 1. Number of healthy and mastitis cows on the studied farms

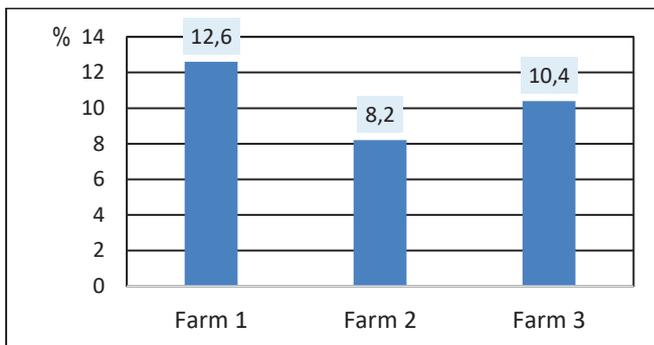


Figure 2. Cows with mastitis (%) on the studied farms

Table 2. Economic results of cows affected by mastitis and healthy cows on Farm 1

Parameters, BGN	Cows with mastitis, n=49	Healthy cows, n=51
1. Income	223587	234916
2. Expenses	136465	131291
2.1. Labour	45013	46538
2.2. Fodder	70805	73695
2.3. Treatment	17609	7896
2.4. Water and electricity	3038	3162
3. Profit	87122	103625
4. Profit per animal	1778	2032
5. Cost-efficiency of expenses	63	78
6. Production cost	0.61	0.55

Regarding profit per animal, the results were quite apparent and 14.3% higher for healthy animals. As a result of less marketed milk, increased expenses, mostly for treatment, reduced fat and protein content, and a higher somatic cell count in the milk of ill cows, losses per cow affected by mastitis amounted to BGN 254. The cost-efficiency of healthy cows' expenses was 15% higher than it was for ill cows. The production cost of 1 kg of milk of healthy cows was lower by BGN 0.05, and as a percentage the difference was 11%.

Analysis of the economic parameters for Farm 2, as indicated

in Table 3, revealed that healthy cows brought 7.8% more income than the ones affected by mastitis. With regard to expenses, there were no significant differences between healthy and sick cows. Losses from clinical mastitis per animal amounted to BGN 277, or 21.2% per dairy cow. The higher profit in healthy cows was due to the greater amount of vended milk for processing, and the milk's higher quality. Regarding the cost-efficiency of expenses, healthy animals surpassed the sick ones by 16%, and in terms of the production cost of 1 kg of milk, this difference was 10.3% in favour of the cows without mastitis.

Table 3. Economic results for cows with mastitis and healthy cows on Farm 2

Parameters, BGN	Cows with mastitis, n=28	Healthy cows, n=72
1. Income	145544	405316
2. Expenses	93820	236512
2.1. Labour	25940	65700
2.2. Fodder	56075	144194
2.3. Treatment	10069	22154
2.4. Water and electricity	1736	4464
3. Profit	51724	168804
4. Profit per animal	1847.3	2344.5
5. Cost-efficiency of expenses	55.0	71.0
6. Production cost	0.64	0.58

It was apparent from the data presented in Table 4 that there were no significant differences between the income and expenses of healthy cows and cows affected by mastitis on Farm 3. This was found in the profit per animal, which was 8.4% higher for healthy cows. This farm also exhibited an increase in expenses for treatment, with the group of ill animals causing

the spending of 64.1% more funds for medication. Total loss due to mastitis per animal amounted to BGN 171. Significant differences between the groups were not observed with regard to expenses, cost-efficiency and the production cost of a kilogram of milk.

Table 4. Economic results for cows with mastitis and healthy cows on Farm 3

Parameters, BGN	Cows with mastitis, n=42	Healthy cows, n=58
1. Income	209412	297162
2. Expenses	131124	179126
2.1. Labour	44932	64050
2.2. Fodder	71153	100260
2.3. Treatment	11986	10600
2.4. Water and electricity	3053	4216
3. Profit	78288	118036
4. Profit per animal	1864	2035
5. Cost-efficiency of expenses	59.0	65.0
6. Production cost	0.62	0.60

It was apparent from Figure 3 that the values of the absolute economic result for all farms included in the study were higher for the healthy animals. This was due to the better quantitative and qualitative parameters of the primary produce – cow's milk, which could be marketed at a better price. Data shown on the figure indicate higher profit from healthy cows – 1.14 times on farm 1, 2.27 times on farm 2 and 1.09 times on farm 3.

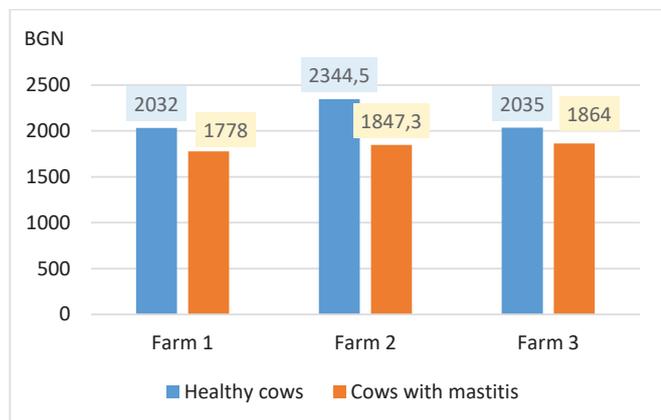


Figure 3. Profit per animal

Our results were close to what was established by Esslrmont (2002) with regard to the losses caused by clinical mastitis per animal, and were lower than the percentage due to the same reason observed by Bascom and Young (1998).

Conclusion

The results obtained indicated that on all of the three studied farms, the cows affected by mastitis exhibited worse economic performance. Profits from healthy cows were from 8.4% higher on the third, up to 21.2% higher on the second farm, compared to the ill cows. Higher cost-efficiency and lower production cost for the milk were established for the healthy animals, which was due to the better marketing of the milk for processing, and the milk's higher selling price. The losses, expressed in BGN value, were BGN 254 for the first farm, BGN 277 for the second farm, and BGN 171 for the third farm, respectively. Apart from the deteriorated economic parameters in the cows affected by clinical mastitis, their productive longevity and lifetime utilization registered through culling of the animals were reduced by a value ranging from 8.2% for the second farm, up to 12.6% for the first farm.

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