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FACTORS INFLUENCING PRODUCTION COST OF COW MILK IN BULGARIAN DAIRY FARMS

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Abstract

This research is aiming at exploration of some factors, influencing production cost of cow milk in Bulgarian dairy farms. Seventeen dairy cattle farmers in Bulgaria were enquired. Pearson correlation coefficients between the following variables were calculated and analyzed: cow number, average milk yield, clinical mastitis, calves' mortality up to 6 months of age, endometritis, expenses for medications per 1 cow, cows per 1 worker, and production cost per 1liter milk. Also a regression model with an application of the Ordinary Least Squares Method was developed. The model has the represented form: $Pc = c + c_1.Cw + c_2.My + c_3.Em + u$, where: Pc – natural logarithm of the production cost per 1 liter of milk; Cw – natural logarithm of cows per 1 worker; My – natural logarithm of average milk yield; Em - natural logarithm of expenses for medications per 1 cow; c_1, c_2 and c_3 – coefficients in front of the regressors; c – constant; u - error of the regression. Growth in clinical mastitis leads to drop down of milk yield while the medication expenses per cow become larger. Medication expenses per 1 cow also increment with the rise of calves' mortality and endometritis. The production cost is influenced significantly from the cows' number per worker and average milk yield: with the increment of one of them, a decline in production cost per liter is observed.

Key words: *Bulgaria, production cost, correlation, cow milk*

INTRODUCTION

Cost of dairy production has a direct relation to farm's efficiency. Consequential task for managers of dairy cattle farms is to decrease the production cost per 1 l of milk. This aim can be reached either by reducing the amount of production costs on a farm level, or by improving average milk yield.

Forage cost is of a great importance and it can take 50-60% from total dairy costs in small farms [9].

Health problems in dairy cows is another important factor, which lead to economic losses due to increased cost for treating animals and through falling in milk production and increased culling rates [4], [5], [6], [12].

The omissions in farm hygiene as a whole lead to health problems in dairy herd [13]. It is established that clinical mastitis demotes milk yield in dairy cows [7], [11] and lameness is interconnected with higher level of mastitis occurrences [14]. The lame animals have poorer body condition and diminished milk yield [10].

Thus the medication expenses for treating health problems are an integral part of milk production cost.

Another substantial expenditure is the cost of labour: the gross salaries of workers and social securities. Labour costs take substantial part of total costs [2], [8] and influences the cost of dairy production. Besides labour amount fluctuates under the adopted milking system in the farm [1]. Pursuant to some authors [3] expansion of dairy farms improves labour efficiency.

This research is aiming at exploration of some factors, influencing production cost of cow milk in Bulgarian dairy farms.

MATERIALS AND METHODS

In order to achieve the aim, 17 dairy cattle farmers in Bulgaria were enquired. Pearson correlation coefficients between the following variables were calculated and analyzed: cow number, average milk yield, clinical mastitis,

calves' mortality up to 6 months of age, endometritis, expenses for medications per 1 cow, cows per 1 worker, and production cost per 1liter milk. Some of the farmers didn't provide information about a few of the studied indicators, that's why in the correlation table the number of observations varies.

Also a regression model with a confidence level of 95% was developed, on the basis of 6 observations, with an application of the Ordinary Least Squares Method. The model has the represented form:

$$Pc = c + c_1.Cw + c_2.My + c_3.Em + u$$

where: Pc – natural logarithm of the production cost per 1 liter of milk; Cw – natural logarithm of cows per 1 worker; My – natural logarithm of average milk yield; Em - natural logarithm of expenses for medications per 1 cow; c_1, c_2 and c_3 – regressors' coefficients; c – constant; u - regression error. F-statistic, probability, standard error, determination coefficient and adjusted determination coefficient are presented.

RESULTS AND DISCUSSIONS

Table 1 displays coefficients of correlation, found between the researched indicators. The coefficient, computed between clinical mastitis and average milk yield has moderate and negative correlation (-0.507), significant at 5% level.

Medication expenses per cow and percentage of clinical mastitis demonstrate highly significant correlation (+0.771), showing that these indicators are positively and strongly connected.

Medication expenses per cow and calves' mortality up to 6 months of age also show significant link (5% significance level), indicating positive and strong relation (+0.709).

Medication expenses per cow and endometritis is significantly correlated at 5% level (+0.673), showing positive and moderate relation.

Correlation coefficients between production cost of 1liter milk and: cow number (-0.535), medication expenses per cow (+0.604) and cows per worker (-0.678) are higher than 0.5 (or smaller than -0.5), but insignificant.

The conclusion from Table 1 assumes that the increment of clinical mastitis' percentage, leads to significant decline in milk yield while the medication expenses per cow become significantly larger. Medication expenses per cow also significantly increment with rise of calves' mortality and endometritis percent.

Table 2 displays F-statistic of the Pc equation, which is 36.987 with probability of 0.026; R^2 is 0.9823 and the adjusted R^2 is 0.9557.

The negative coefficient in front of the cows per 1 worker (Cw) is significant (-0.218), meaning that the growth of number of cows per worker leads to cutback in the production cost per 1 l of milk (Pc). The same tendency is observed between the average milk yield (My) and production cost (significant coefficient of -0.645) – with the increment of average milk yield the production cost per 1 liter drops down. The coefficient of medication expenses per cow (Em) is positive, but insignificant.

Therefore we can conclude that the production cost per 1 liter of milk (Pc) is influenced significantly from the cows' number per 1 worker (Cw) and the average milk yield (My). The logic behind the significance of the cows per one worker is that: the smaller the value of cows per worker, the higher number of workers in the farm, which reflects on the higher sum of salaries and social securities and enlarges the production cost of cow milk.

If we substitute the actual values with the calculated coefficients in front of the regressors in the model, the next equation is obtained:

$$Pc = 5.590 - 0.218.\ Cw - 0.645.My + 0.032.Em$$

Table 1. Correlation coefficients between the variables in the studied dairy farms

Variable		Cow number	Average milk yield (l)	Expenses for medications per 1 cow (BGN)	Cows per 1 worker	Production cost per 1 liter milk (BGN)
Cow number	Correlation coef.	1	0.472	-0.406	0.153	-0.535
	Number of obs.	17	17	10	12	6
Average milk yield (l)	Correlation coef.	0.472	1	-0.383	0.102	-0.010
	Number of obs.	17	17	10	12	6
Clinical mastitis (%)	Correlation coef.	-0.165	-0.507*	0.771**	-0.120	0.270
	Number of obs.	17	17	10	12	6
Calves' mortality up to 6 months of age (%)	Correlation coef.	0.030	-0.261	0.709*	0.120	0.181
	Number of obs.	17	17	10	12	6
Endometritis (%)	Correlation coef.	-0.118	-0.405	0.673*	0.048	0.196
	Number of obs.	17	17	10	12	6
Expenses for medications per 1 cow (BGN)	Correlation coef.	-0.406	-0.383	1	-0.101	0.604
	Number of obs.	10	10	10	9	6
Cows per 1 worker	Correlation coef.	0.153	0.102	-0.101	1	-0.678
	Number of obs.	12	12	9	12	6

* 5% significance level, ** 1% significance level
Source: Own calculations.

Table 2. Estimation of the regression model for the production cost per 1 liter of milk (Pc)

Variable	Coefficient	Standard error	t-statistic (probability)
Constant	5.590	1.228	4.5533 (0.045)
Cows per 1 worker (Cw)	-0.218	0.030	-7.2825 (0.018)
Average Milk yield (My)	-0.645	0.130	-4.9514 (0.038)
Expenses for medications per 1 cow (Em)	0.032	0.011	2.8780 (0.103)
R^2	0.9823		
Adjusted R^2	0.9557		
Standard error	0.0191		
F-statistic (probability)	36.987 (0.026)		

Source: Own calculations.

Figure 1 represents the actual and fitted production cost per 1 l cow milk in the studied dairy farms. The actual and fitted values match well, showing that the model is suitable for analysis of production cost in the studied dairy farms.

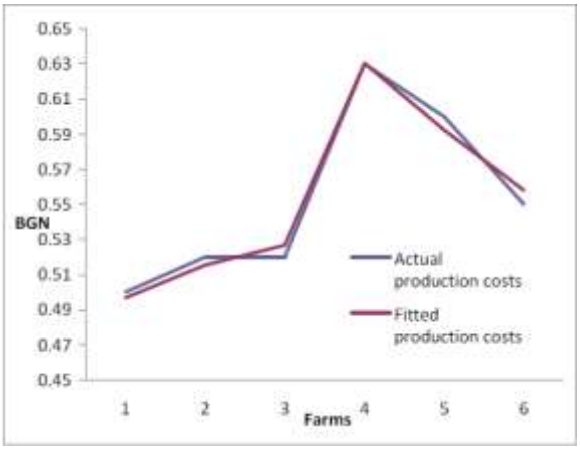

Fig. 1. Actual and fitted production costs (in BGN) of cow milk in the studied dairy farms.
Source: Own calculations.

CONCLUSIONS

Growth in clinical mastitis leads to drop down of milk yield while the medication expenses per cow become larger. Medication expenses per 1 cow also increment with the rise of calves' mortality and endometritis.

The production cost per liter is influenced significantly from the cows' number per worker and the average milk yield: with the

increment of one of them, a decline in production cost per liter is observed.

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