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ECONOMIC AND MANAGERIAL ASPECTS OF THE CATTLE KEEPING IN SLOVAKIA

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Summary

The main attention of this study is devoted to the analysis and evaluationof both economic and managerial aspects of the milk cow keeping in Slovakia during 2000 – 2006. The study demonstrates the quantitative research. Data of milk cow stocks, average milk yield, own production costs of milk and own costs per feeding day were collaborated by matematical methods, including an exponential function, a non linear function, a linear line, a correlation analysis and a trend´s method. During 1989 – 2001 the milk cattle stocks in Slovakia decreased by 42,75 %. It will be continued up to 2006. Since 2006, the Slovak Republic has had the quota for milk production in total volume, which enables the increase of average milk yield per 1milk cow and on the other hand the decrease of number of milk cows during 2007 with prediction up to 2013. Based on the data of cattle stocks we can state that the prediction of development of cattle stocks has decreased tendency regarding with power function $y = 2\,032{,}7 \cdot x^{-0{,}4501}$ and correlation coefficient $R = 0{,}974$. Thereby, the prediction of cattle number is at the level 477 400 in 2013 and the same situation is in the milk cows. According to prediction model based on the exponential function $y = 2\,745{,}9 \cdot e^{0{,}0377\,x}$ and correlation coefficient $R = 0{,}901$ it was found out an estimation of yearly yield 7 047 litres of milk per 1 milk cow in 2013. It means development of raw milk production from 5 670 litres per 1 milk cow in 2006 up to 7 047 litres per 1 milk cow in 2013 with 24,29 %. The economic efficiency of milk cow keeping depends on both the increasing of received average milk yield and natality of milk cows as well as of the keeping of year – on – year cost´s level over the level of average yearly inflation.

Key words: cattle, milk cow, milk quota, milk production costs, feeding day

Introduction

At present time, the cattle keeping includes the most important problems from the viewpoint of the both biological and economic character of agriculture. Dairy cattle keeping is a leading branch of animal husbandry.

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It means that dairy cattle production is an important industry of the animal production in the Slovak national economy with its employment rate and values of products. Generally, it provides production of high quality food – milk and meat, and also raw material or leather and other industrial products. It represents one of the most complicated from both technological and economical point of view branches of animal husbandry. The limited factor of development of cattle keeping are the possibilities of milk and meat products, economic efficiency of its production as well as purchase power of inhabitants. Other framework of cattle keeping is affected by the EU market regulations according to the Common Agricultural Policy, which deals with several problems, solutions of which require an implementation of the different effective measures in the Slovak entities with primary agricultural production (Blaas, 2003). It is necessary to build a model of multifunctional agriculture, which would secure quality and sufficient nutrition of foodstuffs for inhabitants, the competitive and efficient agricultural sector in order to be able penetrate the common Europen market. The authors (Hambalková, 2000; Hudák and Ubrežiová, 2003) deal with this situation in agricultural and food complex in the scientific publications. Krasnodebski et al. (2004) described the situation in Poland while raw – milk production occupies an important position in Polish agricultural and food sector.

Dairy cattle keeping is a main producer of milk – raw material for the Slovak milk processing industry and has significance from the viewpoint of regular cash flow. Milk and milk products take place in human nutrition. The production and consumption of milk products have declined tendency since 1989 as a consequence of the permanent decline of demands on the consumer market. But the milk production plays an important role at the keeping and creation of ecological balance with regard to the mountain and sub-mountain regions. After accession of the Slovak Republic to the EU countries in May 1, 2004 the situation was changed. The raw milk production is affected by quota of raw – milk production. National milk quota of raw – milk production for Slovakia from April 1, 2005 till March 31, 2006 consists of the milk quota in total– 1 000 594 404 kg and for direct sale 9 721 596 kg. It means that the total raw – milk quota was determinated 1 013 316 000 kg. The raw – milk quota is an actual indicator. It is 193 kg milk per 1 inhabitant and year in Slovakia in comparison with 316 kg per 1 inhabitant and year in the EU countries (Anonymous, 2006).

Material and methods of work

Based on the information above, the main goal of this study is to determinate the economic and managerial aspects of the cattle keeping with regard to the milk cows and raw milk production in Slovakia during 2000 – 2006.

Towards to get the main goal the data were gathered from the research tasks, the Slovak Statistical Office, the Economic Research Institute of Agriculture and Food and the information from agrarian and nutritive politics of the Slovak Republic. Secundary data were obtained from the database of natural and economic indicators from the Institute of Animal Production in Nitra (Ubrežiová and Mihina, 1998).

Due to data collection we can rethink the role of the mathematical methods for their using to analyze the development tendencies in the both cattle and milking cows keeping, yield, production and purchase of milk as well as the evaluation of the milk efficiency production. With regard to the partial goals, in our view we have decided to use the following methods for collaboration of data.

Linear extrapolation is helpful at the solution of prognosis of developing tendecies in the future. This methods is used for prediction of development of cattle, milk cows and yield. Linear extrapolation of future economic values is based on the both mathematical and statistical methods of time period with identical conditions for past, present and future. Taking all these knowledge into account, the historical process of mathematical function should be kept at the linear, exponential and logistic function with two or more parameters. The selection of function curve is necessary the rethinking of the historical and future development from two mutual views – economical and mathematical. An economic feature of development can be divided into expansive (increase or decrease) and damped. From this viewpoint the mathematical functions have following appearance:

1st – expansive developing features are created by an *exponential function:*

$$y = a \cdot e^{x}$$

where: a, b = parameters
x = time

or a *non linear function:*

$$y = a \cdot x^{b} \quad b>1,\ a>0.$$

Development of adequate feature are expresed by *a linear line*:

$$y = a + b \cdot x\ .$$

2 [nd] - the features, which have a damped development are often created by *a non linear line*:

$$y = a \cdot x^{b} \quad 0<b<1.$$

Within the mathematical functions mentioned above, the economic view has a priority at the selection of the curves for prognosis. An availability of curves is tested by correlation coefficient or Index of correlation. Practical problem of economic prognosis differs from process of prognosis as well as prediction.

The results of quantification of both reserve and potential possibility are verified by *correlation analysis* or *trend´s method*. Researchers have to solve two basic tasks in connection with the statistical solution of dependent quantitative variabilities. There are:

- *regression task* is aimed at the characteristic of dependance between variability and suitable functional relations,
- *correlation task* is aimed at the determination of characteristic about quality of functional relations.

If it follows from a model of classic linear regression:

$$Y' = \beta_0 + \beta_1 X$$

the point estimation of this regression line is a function

$$y'_j = b_0 + b_1 x_j$$

and the Index of Determination is possible to calculate according to formula:

$$I^2 = \frac{V}{C} = \frac{\sum_{j=1}^{n} \left(y'_j - \bar{y}\right)^2}{\sum_{j=1}^{n} \left(y_j - \bar{y}\right)^2} = r^2$$

The Index of Determination for linear function is called the Coefficient of Determination.

Apart from the linear regression functions we can use a lot of non linear function with two or more parameters in the practice.

Results and discussion

Slovakia is a country with favourable conditions for cattle keeping. According to (Murgaš, 2006) an present entrepreneurial environment is characterized by continued process of globalization. This phenomenom has affected the agricultural production in all EU countries.

During 1989 – 2001 the milk cattle stocks in Slovakia decreased from 559 000 pieces (pcs) to 239 000 pcs, which was decrease by 42,75 %. It will be continued up to 2006. Střeleček et al. (2004) delt with the development of livestock since 1990. Since that year, beef and dairy cattle numbers have dropped by more than 50 % in the Czech Republic. In the same time the development of milk yield after 1989 is shown on the rapidly decline, mainly in the first years of restoration during 1991 – 1993. From the viewpoint of milk development, the unfavourable state was after 1989 and the time of increase of milk production was slow. In spite of this situation, the average yearly milk yield 4 653,5 liter per1 milk cow was marked in 2001.

Time period to 2006 is marked by decline of cattle stocks, including milk cows in Slovakia. In comparison with previous period from 1989 – 2000 the decline was slower. The reduction in number of cattle was substantially caused by such factor as refusal of administrative methods of managing, structural reorganization of the agricultural sector, high level of expenses in animal husbandry, non or underdeveloped marketing systems, etc. Last year the number of cattle was stabilised.

The following table 1 shows the number of cattle stocks, including milk cows and the average, milk yield per 1 milking cow. The cattle stocks have declined with 126 000 pcs (80,50 %) since 2000. The same situation is in the milk cows. The number of milk cows has declined by 54 000 pcs (78,0 %). In

2006, the average milking cow number was decreased from 198 000 thousand heads to 192,5 thousand heads, it means by 3 % in comparison 2005 (Šajbidorová, 2007). The average of milk yield per cow in this study was 5670,0 kg per 1 milking cow and year. This amount was lower by 343 kg per 1 milk cow and year in connection with average milk yield in the EU – 25 countries in 2006 (6 013,0 kg per 1 milk cow and year.).

Table 1. – NUMBER OF CATTLE STOCKS, MILK COWS, AVERAGE YEARLY MILK YIELD AND MILK PRODUCTION IN SLOVAKIA DURING 2000 – 2006

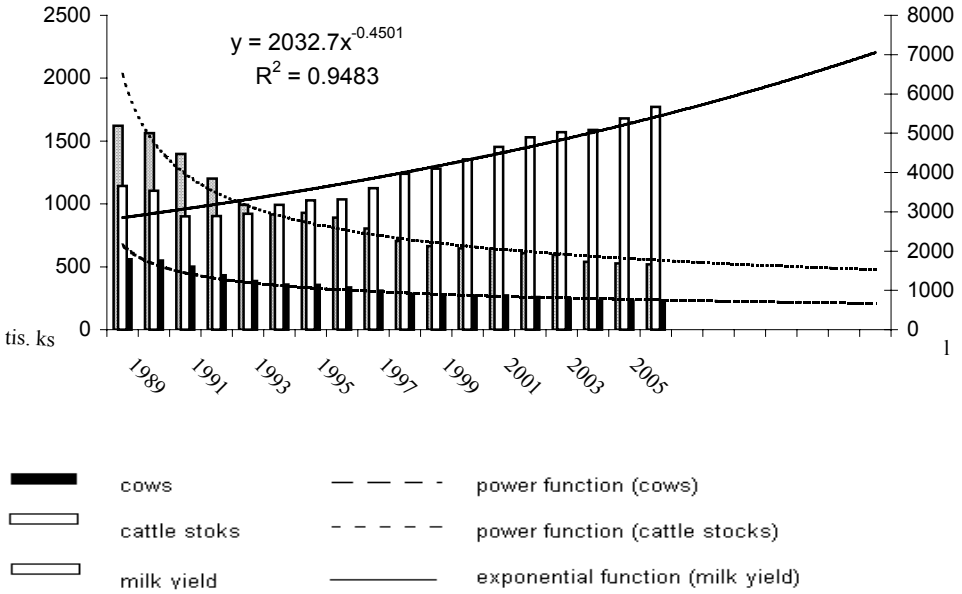
Year	Number of cattle stocks (in thous. pcs.)*	Number of milk cows (in thous. pcs.)*	Yearly milk yield (in litres per cow)	Milk production (in mil. litres)
2000	646,1	246,2	4336,7	1067,0
2001	644,9	239,3	4653,5	1113,8
2002	607,8	237,4	4898,2	1162,9
2003	593,2	220,5	5028,5	1108,9
2004	540,1	206,0	5083,2	1047,9
2005	527,9	198,5	5380,4	1067,8
2006	520,0	192,5	5670,0	1091,7

Note: in thous. pcs* - in thousands of pieces
Source: The Economic Research Institute of Agriculture and Food and own calculations

Generally, this yield is expected to increase to around 5 790,8 kg per 1 milk cow and year by 2007 due to growth of intensity of milk production. Since 2006, the Slovak Republic has had the quota for milk production in total volume 1 040 788 000 kg, which enables the increase of average milk yield and on other the hand the lower decrease of number of milk cow during 2007 – 2013. The Slovak Republic has to adapt to the new EU conditions from the viewpoint of raw cow milk production . The Direction of Council EU No. 92/46 about hygienic order for production of milk and milk products, the Direction EU No.93/43of food hygiene as well as other supplements belong to the basic orders forthe Slovak legislation.

It can be seen from graph 1 that the prediction of development of cattle stocks has decreased tendency regarding with power function $y = 2032 \cdot x^{-0,4501}$ and correlation coefficient R = 0,974. By analyzing the futher development we have taken into account that the number of cattle stocks will be 477 400 pcs and the same situation is in the milk cow keeping.

Graph 1. – FUNCTIONS OF DEVELOPMENT OF CATTLE STOCKS AND AVERAGE MILK YIELD TO 2013 IN SLOVAKIA (IN THOUS. PCS AND LITRES PER1 MILK COW AND YEAR)



Graph 1 is described the situation in this category of cattle. We can state that the bigger decay of milking cows was during 2002 – 2003. There is a hypothesis of smaller milk cow decline according to power function $y = 671{,}3 \cdot x^{-0{,}3612}$ with correlation coefficient $R = 0{,}976$. Based on the obtained results from this study, there is no doubt an inevitable to realize the changes in both macro and micro environment of business entities.

On the other hand the development of average yearly yield has the increasing tendency. According to prediction model based on the exponential function $y = 2\,745{,}9 \cdot e^{0{,}0377\,x}$ and correlation coefficient $R = 0{,}901$ it was found out an estimation of yearly yield 7 047 litres of milk per 1 milk cow in 2013. It means development of raw milk production from 5 670 litres per 1 milk cow in 2006 up to 7 047 litres per 1 milk cow in 2013 with 24,29 %.

Basic solution of economic situation in the business entities with primary agricultural production, including crop and animal production is to abolish a disproportion between production costs of milk and sale prices of milk. Production costs of milk belong to the most important indicator for the evaluation of economic efficiency of milk production.

Theory of costs in the production economics share the theory of production in total. Production costs related to raw milk production are analyzed by classifying production costs as variable and fixed costs (Ubrežiová and Mihina, 1998, Paška, 2004 and Demircan et al, 2006). Milk production economy depends on the milk production costs and other indicators. No doubt, the farmers who are interested in milk cow keeping have to take into consideration tha the increasing of average milk yield per year is the strategic question in connection with decreasing of milk production costs per unit and competitiveness of milk production. On the other hand, a relative emphasis among traits in the breeding for Czech dairy cattle should be reassessed according to the expected situation after shifting to a free market economy in 2015 (Wolfová et al., 2007).

Table 2 is given brief survey of own costs in the milk cow keeping in dependance on average yearly milk yield in Slovakia during 2001 – 2005. In Slovakia, the population of cattle consists of three basic genotypes – the Slovak Spotted breed, the Slovak Pinzgaw breed and the Holstein breed (Chrenek, 1997). It can be seen from the table 2 and graph 2 that the own costs per 1 liter of milk are 10,93 SKK at the interval to 3 000 liters of milk. These own costs are decreased in relation to the increasing of average milk yield per year. It was found that the milk yield gain by 1000 liters there was a decrease by 0,48 SKK. There are 10,40 SKK per 1 liter of raw milk at the average milk yield 5 760 liters per 1 milk cow. The same situation is in the evaluation of own costs per 1 feeding day (Table 2).

Table 2. – OWN COSTS IN COW KEEPING IN DEPENDANCE ON MILK YIELD DURING 2001 – 2005 IN SLOVAKIA

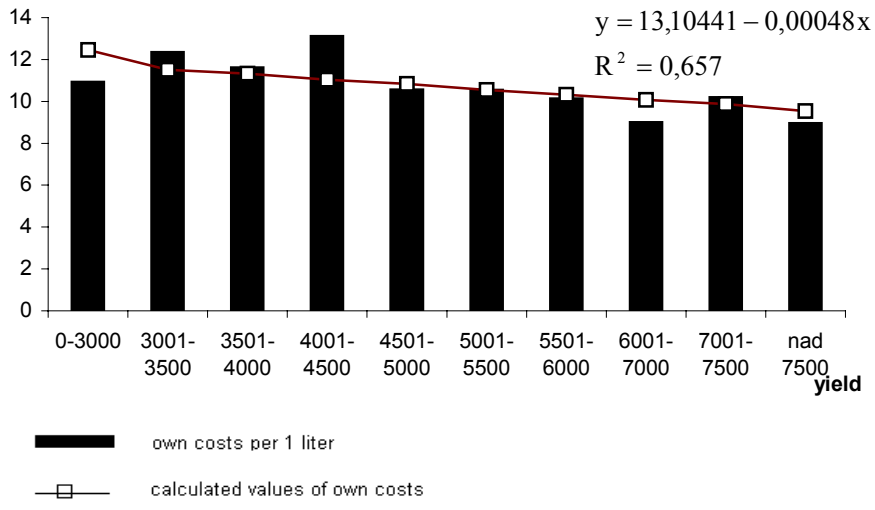
Interval of milk yield per year	Own costs per 1 liter of milk in SKK					Own costs per 1 feeding day in SKK				
	2001	2002	2003	2004	2005	2001	2002	2003	2004	2005
to 3000	12,13	11,58	15,30	11,93	10,93	6471	7161	8289	8838	4076
3001-3500	11,50	14,08	10,10	13,48	12,35	10382	12710	9167	11790	11247
3501-4000	10,46	10,73	11,18	12,05	11,62	10713	11119	11466	12538	11823
4001-4500	10,30	10,29	11,00	11,27	13,11	11935	11878	12726	13259	15444
4501-5000	9,76	9,42	9,59	10,19	10,56	12625	12267	12597	13413	13636
5001-5500	9,09	9,73	9,91	9,91	10,54	12934	13857	14108	14078	15388
5501-6000	8,77	8,63	9,67	9,46	10,13	13866	13844	15135	14885	16126
6001-6500	8,77	8,92	8,62	9,08	9,00	15119	15059	14650	15694	15601
6501-7000	8,96	8,90	8,84	9,88	10,19	16813	16723	16379	18193	18821
over 7000	8,00	7,69	7,86	9,10	8,95	17340	16820	18101	18483	18255

Source: Data from own research and own calculation

In generally, the highest cost item creates the fodder costs, icluding production and bought costs. The fooders have affected the intensity and economy of milk cow keeping. There is necessary to devote the attention to the hay grass production, ensilage and fodder storage. Goal of agricultural primary producers of milk is the utilization of qualitative and cheap bulk fodder at the cow keeping. From the total production of bulk fodders about 60 % are conservated (40 – 45 % of ensilage, 15 – 20 % of hay). The second highest cost item are breeding herd depreciation. Pšenica (1994) defined that the cow is biological production tool with ontogenesis process and by genetic determinated yield. Cow keepers look for the possibilities how to decrease this cost item by continuation of production age of cows from 3 lactation to 4 and more ones.

The decline of overhead costs play an important role in managerial work in animal production as well as in whole enterprise. From the viewpoint of several intervals of average milk yield in table 2 it can be marked the differences in the level of milk productions conditions. The level of overhead costs is mainly affected by different level of organizational and managerial labour as well as on the possibilities of costs decline. According to (Kubanková, 2006) the labour costs participate of the structure of own costs with 9,72 % in 2005. The change of organizational forms of milk production is the way to decline of this cost´s item.

Graph 2. – DEPENDENCY OF UNIT OWN COSTS ON MILK YIELD IN COW KEEPING IN SLOVAKIA DURING 2005



In conclusion we can state that the economic efficiency of milk cow keeping depends on both the increasing of received average milk yield and natality of milk cows as well as of the keeping of year – on – year cost´s level over the level of average yearly inflation. When the milk cows will obtain the average milk production 6 500 litres per lactation and the level of purchase prices will be gently over 10,00 SKK per 1 liter of raw milk cows, i tis possible to say about economic efficiency of milk production with utilization of milk cows more than 4 lactations.

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EKONOMSKI I MENADŽERSKI ASPEKTI DRŽANJA GOVEDA U SLOVAČKOJ

Sažetak

Glavna se pozornost u ovome radu posvećuje analizi i procjeni ekonomskih i menadžerskih aspekata držanja mliječnih krava u Slovačkoj od 2000. do 2006. godine. Rad prikazuje kvantitativno istraživanje. Podaci o broju mliječnih krava, prosječnom prinosu mlijeka, vlastitim troškovima proizvodnje mlijeka i vlastitim troškovima po danu hranjenja izrađeni su matematičkim metodama, uključujući eksponencijalnu funkciju, nelinearnu funkciju, linearnu liniju, analizu korelacije i metodu kretanja. Od 1989. do 2001. broj mliječnih goveda u Slovačkoj se smanjio za 42.75%. Tako će se nastaviti sve do 2006. Od 2006. u Republici Slovačkoj kvota za proizvodnju mlijeka u punom je iznosu, što omogućuje povećanje prosječnog prinosa mlijeka po mliječnoj kravi, a s druge strane smanjenje broja mliječnih krava tijekom 2007., s predviđanjem do 2013. Na temelju podataka o broju goveda možemo reći da predviđanje razvoja broja goveda ima tendenciju smanjenja, što se tiče potencijalne funkcije $y=2032,7 \cdot x^{-0,4501}$ i koeficijenta korelacije R=0,974. Prema tome, predviđa se broj goveda na razini od 477,400 jedinki 2013. godine, a ista je situacija i kod mliječnih krava. Prema modelu predviđanja na temelju eksponencijalne funkcije $y=2745,9 \cdot e^{-0,0377x}$ i koeficijenta korelacije R=0,901 dobivena je procjena godišnjeg prinosa mlijeka od 7,047 litara po jednoj mliječnoj kravi u 2013. godini. To znači povećanje proizvodnje sirovog mlijeka od 24.29%, s 5,670 litara po mliječnoj kravi u 2006. godini do 7,047 litara po mliječnoj kravi u 2013. godini. Ekonomska isplativost držanja mliječnih krava ovisi po povećanju prosječnog prinosa mlijeka i natalitetu krava, kao i o držanju razine troškova iz godine u godinu iznad razine godišnje inflacije.

Ključne reči: govedo, mliječna krava, mliječna kvota, troškovi proizvodnje mlijeka, hranidbeni dan

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