

Economy coefficient and costs of raw milk production depending on the price of animal feed

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World Journal of Advanced Research and Reviews, 2021, 12(02), 483–491

Publication history: Received on 19 October 2021; revised on 22 November 2021; accepted on 24 November 2021

Article DOI: <https://doi.org/10.30574/wjarr.2021.12.2.0638>

Abstract

Food costs are the highest costs in milk production so they need to be minimized. In large dairy farms, the total share of food in the cost structure ranges from 50-60%, while in small farms it is above 60%. By producing one's own voluminous food, the sustainable needs of animals and lower milk production can be met, while higher milk production requires the use of concentrated nutrients produced on one's own farm (corn, cereals). The purchase of ready-mixed feeds should be avoided because it is economically unjustified. Poorer quality and inadequate quantities (more or less than technological needs) in the diet of dairy cows have a direct effect on the amount of milk produced, and thus on income.

The production of own fodder and its use greatly reduces the cost of milk because the internal factors of the farm's business determine the success of the business more than the selling price.

The cost of food in the total cost of milk production participates from 44.50% in small farms that have a grazing system in the feeding, to 56.71% in Holstein cows in 2021.

The share of concentrate in the total cost of feeding is from 55.80% in Holstein cows in 2020 to 71.23% in small farms with a grazing system in the feeding.

The costs of production of corn silage in the feeding ratio in 2020. year amounted 0.0514 BAM / kg, and in the feeding ratio in 2021. Year 0.0433 BAM / kg.

The price of concentrate in the feeding ratio in 2020. Year was 0.55 BAM / kg, and in 2021. Year 0.72 BAM / kg

(1 BAM = 0,511 €) (1 BAM = 0, 59 \$)

The coefficient of economy is from 1.4920 in farms with up to 10 Simmental cows, to 1.8214 in larger Holstein cow farms.

Keywords: Milk; Feeding; Cost; Revenue; Economy coefficient

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1. Introduction

There are significant changes in the prices of animal feed on the domestic and thus on the foreign market, there has been a significant increase in the price of animal feed. The paper compares the price of milk and the impact of the price of animal feed on the economy of milk production in the last two years.

When talking about the economy and profitability of milk production, it is worth emphasizing the general law - under normal conditions, the economy and profitability of milk production per cow increases to a certain extent after which the economy and profitability begin to decline. This limit is lower in low-milk than in high-milk breeds due to the ratio of abstinence and production needs of the head, and the ratio of fixed and variable costs per production head [1].

The cost of materials in cattle production occupies a major place in the cost structure of livestock products. In the case of breeding cows that have been used for several years, the cost price is charged only one part of the value of the breeding herd in the form of depreciation, which is included in the cost price as a group of costs. It can be seen from the above that the basic material for milk production is the food from which the product is created during the production process [2].

The most important factor that affects the economy and profitability of milk production is the nutrition of dairy cows, which affects both the amount of milk produced and the profit in production.

The economics of production in cattle and sheep are based on the maximum use of voluminous feed, which is significantly cheaper than concentrate in the beginning. In countries with large areas under grasslands, animal nutrition is done on pasture, which enables the cheapest production of milk and meat [3].

Labor costs in the total costs of milk production participate with about 10-15% because regardless of the degree of technical equipment, milk production in relation to other productions requires a lot of live labor [4].

Amortization or annual write-off of part of the value of a cow as a fixed asset has the same impact on production efficiency as sustainable food and in the total cost structure ranges from 5 to 15%. Each head enters milk production as a fixed asset and must be repaid in the form of depreciation during the production life. Amortization is calculated by deducting the liquid value from the investment price and dividing it by the number of years the cows have lived [5].

It is recommended that the lifespan of Holstein cows be 4 years and Simmental cows 6 years.

Insurance makes up a significant item in the cost structure and amounts to 6-8% of the value of the animals. Our farmers rarely insure animals.

Other production costs include veterinary services and medicines, operation of agricultural machinery, consumables and more. Their economic impact on total costs is smaller. The cost of milk depends on the amount of production per cow, the number of cows in the herd, the price of animal feed, other production costs, and the technical equipment of the farm and the application of technological solutions [6].

In the normal cost price structure, the economic limit of milk production should be above 10 liters of milk per feeding day.

As a rule, the cost of milk is lower with higher milk production and with herds with a larger number of cows, but there are exceptions to this rule if the cows spend more time grazing. Revenues in milk production are the result of income from milk, income from milk incentives, cow incentives, income from breeding and growth of calves, income from weaned cows and income from manure (by-product) [7].

In the structure of milk production income, the income from milk with incentives is 85-90%, and other income is 10-15%.

Calculation of income and costs of milk production of one average milk producers in BiH in the period 2011-12. Years showed that they are average revenues per milking head were 3,296 BAM, and the average variable costs were 2,265 BAMM. The average gross margin is 1,031 BAMM / head per year and to reduce it or the increase is directly affected by changes in the purchase price of milk and the milk premium. Sensitivity analysis based on increase or decrease of purchase price of milk up to 50% i reduction or increase of the milk premium up to 100%, ie its full abolition, has shown

that the consequences by milk producers range from increase gross margin at 2,309 BAM / head per year to a loss of 247 BAM / head per year [8].

The producer's selling (or purchase) price of milk is an objective factor on which the producer (farmer) can significantly influence the quality of milk (milk fat content, milk proteins and hygiene - microorganisms and somatic cells). The producer can significantly influence the price of milk with a better diet and modern zoo technical production measures.

The basic measures that increase the economy of milk production are those that act to increase revenue while maintaining or slowing down costs. Even small interventions in technology (better accommodation conditions, purchase of milking equipment, use of fodder or other dietary improvements) usually bring producers to the limit of 5,000 liters of Holstein milk.

The estimated production and technological potential of most Simmental dairy cows is about 6,000 liters. When it comes to the production and technological potential of Holstein cow, some target result in our conditions is about 8,500 liters of milk.

2. Material and work methods

Data for the research were collected on farms engaged in the production of raw milk in the Tuzla and Sarajevo Canton.

A survey on the costs of raw milk production, concentrate prices and costs of corn silage production was conducted on a total of 42 farms.

As representative farms, farms with up to 10 Simmental dairy cows, more than 20 Holstein dairy cows, and smaller farms with a grazing cow system are included in the consideration.

Data were collected and processed based on average prices from the surveyed farms.

3. Results and discussion

Table 1 Calculation of milk production on smaller farms up to 10 dairy cattle, Simmental breeds

Term	2020. year		2021. year	
	Unit price	Value BAM	Unit price	Value BAM
Milk production liters/year, 4.720	0.56	2,643.20	0.56	2,643.20
Revenue from milk sales incentive	0.28	1,321.60	0.28	1,321.60
Cow excreted (17%)		200.00		200.00
Calf		850.00		850.00
Manure 12.000 kg	0.01	120.00	0.01	120.00
TOTAL REVENUE		5,134.80		5,134.80
Feeding costs		1,651.70		1,890.48
Veterinary costs		110.00		110.00
Breeding heifers costs (17%)		511.00		511.00
Breeding calf costs		320.00		320.00
Amortization		500.00		500.00
Other costs		110.00		110.00
TOTAL COSTS		3,202.70		3,441.48
PROFIT (Revenue - Costs)		1,932.10		1,693.32
COST PRICE		0.679		0.729

Table 2 Feeding technology

Term	Days	2020. year			2021. year		
		Unit price	Quantity (Kg; lit.)	Value BAM	Unit price	Quantity (Kg; lit.)	Value BAM
Maize silage	365	0.0514	18	337.70	0.0433	18	284.48
Grass silage	365	0.08	5	146.00	0.07	5	127.75
Hay	365	0.15	3	164.25	0.15	3	164.25
Concentrate	365	0.55	5	1,003.75	0.72	5	1,314.00
TOTAL				1,651.70			1,890.48

Production life: 6 year

Calf/cow: 0, 9

Feeding: 365 days

Herd rebuilding: own heifers

Milk quality: % milk fat 4.0 % protein 3.6 Quality class: E

Number of excreted head /cows: 0.17

On the mentioned farms, the coefficient of economy was calculated as the ratio of the value of production and the realized total costs.

2020. Year = E = 5,134.80 / 3,202.70 = 1.6033

2021. Year = E = 5,134.48 / 3,441.48 = 1.4920

The calculated coefficient of economy shows that milk production is economical because the coefficient of economy is greater than 1.

As long as the cost price of the obtained products is lower than their market price in a given production, a positive economic result is achieved and production is economical.

Table 3 Calculation of milk production on the farm with winter and summer meal (pasture) (4 farms)

Term	2020. year		2021. year	
	Unit price	Value BAM	Unit price	Value BAM
Milk production liters/year, 4,100	0.56	2,296.00	0.56	2,296.00
Revenue from milk sales incentive	0.28	1,148.00	0.28	1,148.00
Cow excreted (17%)		200.00		200.00
Calf		850.00		850.00
Manure 12.000 kg	0.01	120.00	0.01	120.00
TOTAL REVENUE		4,614.00		4,614.00
Feeding costs		1,268.79		1,475.87
Veterinary costs		110.00		110.00
Breeding heifers costs (17%)		511.00		511.00
Breeding calf costs		320.00		320.00
Amortization		500.00		500.00
Other costs		110.00		110.00
TOTAL COSTS		2,819.79		3,026.87
PROFIT (Revenue – Costs)		1,794,21		1,587.13
COST PRICE		0.688		0.736

Table 4 Feeding technology

Term	Days	2020. year			2021. year		
		Unit price	Quantity (Kg; lit.)	Value BAM	Unit price	Quantity (Kg; lit.)	Value BAM
Maize silage	210	0.0514	18	194.29	0.0433	18	163.67
Grass silage	210	0.08	5	84.00	0.07	5	73.50
Hay	365	0.15	3	164.25	0.15	3	164.25
Pasture	155	0.01	15	23.25	0.01	15	23.25
Concentrate	365	0.55	4	803.00	0.72	4	1,051.20
TOTAL				1,268.79			1,475.87

Production life: 6 year

Calf/cow: 0, 9

Feeding: 210 days winter meal, 155 days summer meal

Herd rebuilding: own heifers

Milk quality: % milk fat 4.0 % protein 3.6 Quality class: E

Number of excreted head /cows: 0.17

On the mentioned farms, the coefficient of economy was calculated as the ratio of the value of production and the realized total costs.

2020. Year = E = 4,614.00 / 2,819.79 = 1.6363

2021. Year = E = 4,614.00 / 3,026.87 = 1.5243

The calculated coefficient of economy shows that milk production is economical because the coefficient of economy is greater than 1.

The coefficient of economy on this 4 farm is higher than the average of other farms (Simmental breed), although the production of milk per dairy cow is lower, but the cost of feeding in the summer meal is significantly reduced.

Table 5 Calculation of milk production on larger farms of 20 dairy cattle, Holstein breed

Term	2020. year		2021. year	
	Unit price	Value BAM	Unit price	Value BAM
Milk production liters/year, 5,680	0.56	3,180.80	0.56	3,180.80
Revenue from milk sales incentive	0.28	1,590.40	0.28	1,590.40
Cow excreted (25%)		360.00		360.00
Calf		850.00		850.00
Manure 12.000 kg	0.01	120.00	0.01	120.00
TOTAL REVENUE		6,101.20		6,101.20
Feeding costs		1,798.72		2,031.59
Veterinary costs		110.00		110.00
Breeding heifers costs (17%)		511.00		511.00
Breeding calf costs		320.00		320.00
Amortization		500.00		500.00
Other costs		110.00		110.00
TOTAL COSTS		3,349.72		3,582.59
PROFIT (Revenue – Costs)		2,751.48		2,518.61
COST PRICE		0.5897		0.6307

Table 6 Feeding technology

Term	Days	2020. year			2021. year		
		Unit price	Quantity (Kg; lit.)	Value BAM	Unit price	Quantity (Kg; lit.)	Value BAM
Maize silage	365	0.0514	20	375.22	0.0433	20	316.09
Grass silage	365	0.08	5	146.00	0.07	5	127.75
Hay	365	0.15	5	273.75	0.15	5	273.75
Concentrate	365	0.55	5	1,003.75	0.72	5	1,314.00
TOTAL				1,798.72			2,031.59

Production life: 4 year

Calf/cow: 0, 9

Feeding: 365 days

Herd rebuilding: own heifers

Milk quality: % milk fat 4.0 % protein 3.6 Quality class: E

Number of excreted head /cows: 0.25

On the mentioned farms, the coefficient of economy was calculated as the ratio of the value of production and the realized total costs.

2020. Year = E = 6,101.20 / 3,349.72 = 1.8214

2021. Year = E = 6,101.20 / 3,582.59 = 1.7030

The calculated coefficient of economy shows that milk production is economical because the coefficient of economy is greater than 1.

On larger farms, milk production ranged from 5,100 liters to 6,340 liters per dairy cow. This calculation calculates the average milk production per cow on larger farms

Table 7 Share of feeding costs in total costs (%)

Term	2020. year	2021. year
Farm up 10 cow – Simmental	51.57	54.93
Farm winter and summer meal	44.50	48.76
Farm more 20 cow Holstein	53.69	56.71

Table 8 Share of concentrate costs in the feeding cost (%)

Term	2020. year	2021. year
Farm up 10 cow – Simmental	60.77	69.51
Farm winter and summer meal	63.29	71.23
Farm more 20 cow Holstein	55.80	64.68

Table 9 Comparison of the Coefficient of economy

Term	2020. year	2021. year
Farm up 10 cow – Simmental	1.6033	1.4920
Farm winter and summer meal	1.6363	1.5243
Farm more 20 cow Holstein	1.8214	1.7030

Table 10 Calculation of maize silage production

Term	2019. year				2020. year			
	Quantity	Unit	Price per unit	Total BAM/Ha	Quantity	Unit	Price per unit	Total BAM/Ha
YIELD	32,000	kg			40,000	kg		
Seed	3	pack.	90	270.00	3		90	270.00
Fertilizer				385.00				427.50
Pesticides				150.00				175.00
Mechanization				740.00				760.00
Other costs				100.00				100.00
TOTAL COST				1,645.00				1,732.50
COSTS PRODUCTION BAM/kg				0,0514				0,0433

Table 11 Costs of the maize silage production

Fertilizer	2019. year				2020. year			
	Quantity	Unit	Price per unit	Total BAM/Ha	Quantity	Unit	Price per unit	Total BAM/Ha
NPK 15-15-15	300	kg	0.65	195.00	300	kg	0.70	210.00
UREA	150	kg	0.80	120.00	150	kg	0.90	135.00
KAN 27%	150	kg	0.50	75.00	150	kg	0.55	82.50
TOTAL FERTILIZER				385.00				427.50
Pesticides								
	5	lit.	30	150.00	5	lit.	35	175.00
TOTAL PESTICIDES				150.00				175.00
Mechanization								
Plowing	1	Ha	120	120	1	Ha	130	130
Disc harrowing 2x	2	Ha	50	100	2	Ha	50	50

Application of fertilizer 2x	2	Ha	30	60	2	Ha	30	30
Sowing preparation	1	Ha	40	40	1	Ha	40	40
Sowing	1	Ha	50	50	1	Ha	50	50
Application of pesticide	2	Ha	15	30	2	Ha	15	30
Cultivation 2x	2	Ha	50	100	2	Ha	50	50
Harvest	1	Ha	200	200	1	Ha	210	210
Transport	1	Ha	40	40	1	Ha	40	40
TOTAL MECHANIZATION				740.00				760.00
Land rent	1	Ha	100	100	1	Ha	100	100
TOTAL OTHER				100				100.00

4. Conclusion

The application of new technological solutions in milk production is one of the basic measures in increasing the economy of milk production. This refers to the application of new technologies in the feeding of dairy cows, changing the way of keeping dairy cows and the use of appropriate methods of milking and milking equipment.

Replacement of the basic herd, after several lactations (4 - 6), due to greater utilization of genetic potential in the production of milk and heifers for the renewal of the herd would enable the realization of higher incomes. It was also confirmed that always high production does not have to be the most economical, the highest coefficient of economy was recorded in farms that had Holstein cows and significantly higher milk production per head.

The use of winter and summer meals, with a system of grazing cows, also has a significant impact on economy. In these farms, the coefficient of economy is higher, although the production per head is lower, compared to farms that have a Simmental breed of cows.

There is a significant reduction in the cost of production of corn silage (which is the basis of the meal), the cost of production in 2019 per kg was 0.0514 BAM, and in 2020 0.0433 BAM / kg of silage. Factors that led to a decrease in the cost price of silage are an increase in yield, regardless of the increase in production costs, the yield is increased due to favorable weather conditions.

There is a significant increase in the price of concentrate in the diet of cows from 0.55 BAM / kg, to 0.72 BAM / kg. This significantly affected the reduction of the coefficient of economy of milk production.

Compliance with ethical standards

Disclosure of conflict of interest

There is no conflict of interest. The results were obtained by our own survey and questionnaires –Midhat Glavić and other coauthors.

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