Scientific Papers. Series D. Animal Science. Vol. LXV, No. 2, 2022
ISSN 2285-5750; ISSN CD-ROM 2285-5769; ISSN Online 2393-2260; ISSN-L 2285-5750

PARTIAL RESEARCH ON THE EFFICIENCY OF DAIRY COW FARMS BY DIMENSION AND GROWTH SYSTEM

Cornelia BILȚIU DĂNCUȘ[1], Cristina Ștefania NEGRE[2], Livia VIDU[1], Gheorghe Emil MĂRGINEAN[1]

[1]University of Agronomic Sciences and Veterinary Medicine of Bucharest, 59 Marasti Blvd, District 1, Bucharest, Romania
[2]Academy of Agricultural and Forestry Sciences, 61 Marasti Blvd, District 1, Bucharest, Romania

Corresponding author email: negre_cris@yahoo.com

Abstract

In the context in which the number of dairy cows in our country is constantly declining in recent years, a complex analysis (technical and economic) of dairy farms was necessary to determine the optimal size and exploitation mode of these categories of cattle in order to obtain a maximum profit. After conducting the three case studies and analyzing the three breeding and maintenance systems, the intensive dairy farming system seems profitable, but it requires the biggest investment, the largest number of staff and well-developed feed bases, based on generous land areas, for the realization of the vast majority of fodder within the unit, thus having the fewest inputs. Without large areas of land and high-performance dairy animals, the intensive system is losing ground to the semi-intensive system, especially as it poses major problems in terms of environmental protection, creating a lot of waste and pollutants.

Key words*: bovines farm, economic efficiency, milk production.*

INTRODUCTION

Today, raising cattle, and especially dairy cows, has become a "living factory" because these remarkable animals can process agricultural raw materials into animal products of great biological value. The most important, most complex and complete product provided by cows to man is milk.

The general demand for milk increased with the development of industry and urban settlements, developing a large number of dairy products, which led to a significant increase in the "prestige" of the cow, which is called the "nanny of mankind". Today, almost everyone consumes milk. In a lifetime, a person consumes, on average, 10,000 liters of milk (Dinu, 1996).

At the present stage, the economic agents in agriculture are permanently preoccupied with the improvement of organizational structures, production technologies, the optimization of material, financial and human resources, the efficiency of their use, to face competition and achieve a major goal - obtaining maximum profit.

Livestock farms are severely affected during this period by a number of factors such as: the restriction of the area intended for fodder production, the sharp rise in prices for compound feeds, seeds of varieties and hybrids with high productive value, water, energy and especially the increase in interest rates on bank loans is currently at a crossroads that requires in-depth studies to find out the real causes that led to the inefficiency of dairy farms in our country and the attractiveness of investors in this field.

Considering the above factors, a thorough analysis of the economic and financial activity was required at the level of the cow farm in order to develop the most appropriate decision - making solutions for the profitability of milk production.

MATERIALS AND METHODS

The main objectives of this paper are to know and study the efficiency of dairy farms depending on the size and type of exploitation. For this, 3 dairy farms were studied, as follows:

- small dairy farm, organized in a household system;
- medium-sized dairy cow farm, organized in a semi-intensive system;
- large dairy farm, organized in an intensive system.

The analysis of the technical and economic efficiency cannot be done without a presentation

of the conditions in which the milk production of these animals is registered, therefore a brief presentation of the technology of exploitation of dairy cows, as well as of the related youth was made. This specifies the breeding results of these animals as well as the way of maintenance - animal shelter, body care, movement of cows, feeding technology and milking technology.

This paper presents and makes an interpretation of the technical-economic results of the farm activity from the point of view of the following indicators:

1. Technical indicators:
- Dynamics and structure of livestock;
- Dynamics of animal production obtained: milk production (average, total); increase production (average, total); calf production;
- The dynamics of plant production and its structure;

2. Economic and financial indicators:
- The operating costs of dairy cows and their structure by categories of expenditure;
- The actual unit cost of milk;
- Revenues obtained and their structure;
- Final financial results.

These indicators have been studied in dynamics over the last three financial years, focusing on the factors that have contributed to obtaining favorable results, how to improve the activity, as well as the ways to achieve them.

The technical-economic analysis deals with the study of the economic-financial results obtained by the economic agents, of the factors and causes that generated them, as well as the ways and measures that must be taken in order to increase the efficiency of activities in all patrimonial units.

In farms and other agricultural units, the technical-economic analysis allows the manager to observe in time the shortcomings that arise during the implementation of the activity program, to know exactly the situation in each sector of activity, the resources it has, being able to take, the most appropriate measures to achieve the annual and future objectives (Oancea, 2003).

This analysis highlights the methods that are the best for management and creates the possibility of generalization, ensures their permanent adaptability in the concrete, real conditions of each economic unit.

Economic analysis allows the discovery of internal resources to increase production, as well as ways to use them as completely and efficiently as possible. It also finds ways to reduce production costs.

In conclusion, economic analysis is an important tool of scientific management in agricultural units, including livestock farms, which achieves all the attributes of management, objectives and functions of the unit as a system. It is an effective means of diagnosing, regulating, optimizing and programming the activity of agricultural units, the information provided following these analyzes being the foundation of the decision-making process.

The technical-economic analysis includes the whole set of methods and procedures used by this science to research the economic reality and evaluate the results obtained in an agricultural unit (Oancea, 2003).

The technical-economic analysis, to know all the phenomena and economic processes, uses a series of methods, techniques and procedures that intertwine with each other, due to the fact that all these aims to study causal relations, the mechanism of production and change economic phonemes and processes.

The technical-economic analysis aims at studying the different quantitative and qualitative aspects of the phenomena that take place in the economic units.

Regarding the quantitative characters, the technical-economic analysis uses a series of indicators that characterize the nature, size and evolution of economic phenomena in time and space. These indicators can be synthetic and analytical, volume or qualitative. They can be expressed in absolute quantities with the help of natural units (l, hl, pcs, heads, tons etc.) of value units (RON, convertible currencies) and conventional units (UN, UVM). They can also be expressed in relative quantities, by reporting the percentage of two indicators that express similar phenomena, a situation in which they are called indices. They can be individual, reflecting the variation of a single phenomenon, or group when they reflect complex phenomena, consisting of several simple phenomena. Compared to the base taken as a comparison, the indices can be fixed-based and chain-based (Popescu, 2007).

The most important processes that make up the technical-economic method are: The process of comparing in time and space the different indicators followed; Statistical grouping procedure; The division process; Graphic process; The process of chain substitution of factors (Popescu, 2007).
The process has two variants: a variant for the case when the relationship between factors is product and another variant when the relationship between factors is related.
If we have a product relationship, the process requires that these factors be considered variable in turn, while the others remain constant. For the correct application of the procedure, the following rules must be observed: The factors are in the order of their conditioning; Factors are replaced successively; A substituted factor remains substituted until the end; Replacement always starts with the quantitative factor.

RESULTS AND DISCUSSIONS

In terms of location and geographical conditions, the 3 units are located in plain areas, two in the northern part of the country and one in the southern area. The northern ones benefit from a milder climate and milder winters than the southern ones, which have warmer summers and colder winters.
The legal form of the three farms is different, the small one is organized in a Self-employed Person system, the medium one is an LLC and the one with the largest number of dairy cows is a commercial company.
Regarding the indicator - the size of the farm - both according to the land area owned and the number of owners, the three units are thus delimited, the small one has a number of 10 cows and an area of only 2 ha of arable land, the medium-sized one has 30 cows and an arable land of 9 ha, and the large one has 226 dairy cows and an arable area of 1540 ha.
The two small and medium-sized farms compensate for the lack of agricultural land by granting pasture that provides both green mass for dairy cows during the summer and hay for the cold season.
Given the number of animals, the land area owned, as well as the characteristics of the cow maintenance systems, the three units fall into the three classic operating systems: extensive (household), semi-intensive and intensive (Table 1).

Table 1. Unit identification data

Specification	**Farm type**		
	Small	Medium	Large
Location	Northwest (Livada)	Northwest (Salonta)	South
Geographical area	hill depression	plain	plain
The types of soil encountered	brown and peat	brown	brown chernozem – reddish forest
Climate regime	panonic type	panonic type	continentally-tempered
The destination of the farm	commercial farm which produces cow's milk		
The legal form of functioning of the farm	Self-employed Person	LLC	SA
Farm profile	mixed activity - vegetable and animal		
Farm size by surface	2 ha of agricultural land and leased pasture	9 ha of agricultural land and leased pasture	1540 ha agricultural land
Farm size by livestock	10 dairy cow heads from the Bălțată Românească breed and the related youth	30 heads of dairy cows from the Bălțată Românească breed	533 heads of dairy cows from the Bălțată Românească breed
Degree of mechanization on the farm	household system	semi-intensive	intensive

The technical equipment, as can be seen in Table 2, is different from one unit to another, while the farm needs a shelter, a haymaker, a shed and a dairy area, the other farms require larger investments, in more generous spaces, which serve units to the correct flows are ensured.

Table 2. Technical equipment of farms

Farm type		
Small	Medium	Large
Shelter; Paddocks; Dairy; Shed; Haymaker.	2 shelters; Paddocks; Dairy; Grain storage; Shed; Haymaker.	Veterinary sanitary filter; Dairy Installation for capturing solar energy Feed mill Material warehouse Shed 5 haystacks 15 silo cells Access roads to the farm 2 shelters arranged for maternity (2 shelters with 38 places each, resulting in a capacity of 76 accommodation places for cows and their calves); 2 outdoor paddocks; 5 shelters for dairy cows, each with a capacity of 104 seats; 1 youth shelter 3-6 months; 1 youth shelter 6-12 months; 1 youth shelter 12-18 months; 1 youth shelter over 18 months.

The differences in buildings and facilities are great between the three farms, if for the household system one shelter is enough, for the semi-intensive 2 shelters, for the intensive one a number of 5 shelters are needed for dairy cows, 2 for maternity and 4 for calves and youth of different ages.
The large farm, which also has a large area of agricultural land, needs, in addition to all the items listed in the table below, agricultural machinery and equipment that provides a mechanized basis for the properly work of the land. Over time, fewer and fewer people are available for employment in animal husbandry. From this point of view, the small farm is advantageous because it uses only the labor force of those within the family.
The medium-sized farm is primarily based on the permanent presence of the farmer (owner) and a small number of employees. Instead, the large farm needs a well-established staffing scheme to ensure the smooth running of the entire business within the unit. This requires both Technical, economic and socio-administrative staff and skilled workers (Table 3).

Table 3. Workforce in the units

Farm type		
Small	Medium	Large
Family and occasionally day laborers	3 employees and the farmer's family	- farm manager, economist - 2 technicians -10 milkers - 7 youth caregivers - 1 electrician - 3 mechanics - 3 night caretakers - 3 machine drivers - 1 dairy worker, - 1 forklift driver

The housing and restraint system of cows is different from one farm to another, while in all systems the cows are kept tied to the stand of medium size, the time period spent in the shelter is different. In the farm and semi-intensive farm, the cows are tied up in winter, during the summer they are free to graze during the day and sheltered at night.
In the intensive system, the cows are tied up in the shelter and only when the weather allows it are they directed to the outdoor paddocks where they are free.
In small farms, the movement of animals is easy, as the herd grows, this goal is more difficult to achieve, which can lead to foot problems.
The feeding technology is different in the three systems. In the household and in the semi-intensive system, feeding is done by grazing during the summer and by ration administered in a shelter during the winter. The winter ration includes hay, vegetables (often produced by the farmer or by-products of his household: potatoes, pumpkin, etc.) and a concentrated supplement obtained from grinding cereals.
In the intensive system, the feeding technology is complex and includes rations adapted to the age, category of animals, physiological condition and production of each animal. The unit must create a culture plan adapted to the requirements of the unit and moreover, it must purchase various products that cannot be made within it (vitamin-mineral premix, salt etc.). From this point of view, the management of the feed base becomes an important topic within the farm and has a large share in the unit's expenses.
Milking technology is similar in all units studied. In order to obtain a quality milk that can be marketed later, proper milking hygiene is required. Thus, all farms have been equipped with automatic canning milking systems, which ensure the premises of a compliant milk. How to store milk is also important, if in the small farm this is done in stainless steel vessels located in the dairy area, on medium and large farms large cooling tanks are needed to be able to store in optimal conditions the milk obtained.
Reproduction is an important component of farm management. At the farm, the reproduction is done naturally directed. This has the advantage that the date of calving, paternity is known and it is thus possible to achieve a more careful exploitation of the dairy cow. The birth rate obtained in this case was 80%. In a small herd of cows, the heat period can be easily tracked and the mounting is done at the optimal time.
On medium and large farms, reproduction was done by artificial insemination. The birth rate fell to 78% and 74% respectively for the large birth rate. The larger the number of dairy cows, the more time and attention the breeding activity requires from the farmer. In the large farm there is a calendar of uniform distribution of mounts and calving interval during a year, but even so it remains a major challenge for the manager, the optimization of the breeding activity (Table 4).

Table 4. Accommodation system analysis

Specification	Farm type		
	Small	Medium	Large
Shelter construction	- wooden shelter	- brick shelter with cement plaster and asbestos-cement roof	- brick shelter with cement plaster and roof made of galvanized sheet metal
The technology used	Tied up, medium size stand	Tied and free	Tied and free
Manure disposal	Manually	Manually	Mechanized
Ventilation	Naturally	Naturally	Naturally
Shelter hygiene	Disinfection, disinfection and rodent control		
The movement of animals	Pasture	Pasture	Outdoor courtyard
Feeding technology	Summer - pasture Winter - hay, succulents and concentrated supplement	Summer - pasture Winter - hay, succulents and concentrated supplement	Single mixture ration
Milking technology	Milking machines	Milking machines	Milking machines
Reproduction technology	Directed natural reproduction	Artificial insemination	Artificial insemination
- natality	80%	78%	84%

As can be seen in the table, the structure of the herd owned by each farm is simpler in the case of the small and medium-sized farm, the large farm has all the categories of cattle in operation. Tracking the evolution of each animal becomes a challenge for the manager, and requires a lot of time and additional human resources for each individual (Table 5).

Table 5. Livestock structure

Specification	Farm type		
	Small	Medium	Large
Livestock structure	- 10 dairy cows - 5 heifers - 5 calves - 4 calves	- 30 cows - 5 heifers - 7 calves	- 226 dairy cows - 55 heifers - 34 calves over 18 months - 34 calves 12-18 months - 44 calves 6-12 months - 32 calves 0-6 months - 28 calves 0-6 months - 80 fattening cattle

From the economic-financial analysis carried out at the level of the three farms, it can be seen that only the large one can be profitable. The small one, if the salary of the farmer and his family were considered, would have an annual deficit of -7,314 RON. At the medium-sized farm, the profit is RON 15,016.5 without considering the owner's salary, with his remuneration reaching a deficit of -112,207.5 RON. As can be seen, the deficit is increasing as the number of dairy cows kept increases.

For the large dairy cow farm, where there are both various investments and multiple expenses, the income was still considerable and at the end of 2020 a profit of +257,330 RON was registered (Table 6).

Table 6. Analysis of economic-financial indicators at farm level

Specification	Farm type		
	Small	Medium	Large
Annual production per cow (l)	3,820	4,050	5,849
Total farm production (l)	57,300	121,500	1,278,100
Total production delivered (l)	45,840	120,000	1,275,100
Total expenses (RON)	7,874 (without farmer's salary)	144,383.5 (without farmer's salary)	1,341,390
Total income (RON)	85,376	159,400	1,598,720
Profit (RON)	+77,502 (no salaries) -7,314 (with salaries)	+15,016.5 RON (no salaries) -112,207.5 (with salaries)	+257,330

CONCLUSIONS

Following the analysis of the activity carried out by the three farms under study, the following conclusions were drawn:

1. The units analysed are located in different geographical areas of the country, in the plains, being organized under different legal systems according to the number of animals and land areas owned and fall into the three classic systems of exploitation: extensive (household), semi -intensive and intensive.
2. The need for buildings, facilities and labor force show obvious differences between the three units studied. The need for labor is scarce across the country, and additional insurance measures are needed, such as involving family members on the farm.
3. While the maintenance system and the feeding technology are different in the three operating systems, milking is similar, due to all the hygiene measures necessary to ensure a high quality milk that complies with the relevant legal regulations.

4. It has been observed that the larger the number of dairy cows, the more time and attention the breeding activity requires from the farmer. On a large farm, for example, there is a timetable for the uniform distribution of mounts and calvings over a year, but in the average farm, breeding optimization is difficult.
5. From the economic-financial analysis carried out at the level of the three farms it can be seen that only the large one can be profitable. The other two are profitable only if the salary of the farmer and his family is not taken into account.
6. From the analysis of the three rearing and maintenance systems, in this case, the intensive dairy farming system seems profitable, but it requires the most investment, the largest number of staff and well-stocked feed bases that correspond to with generous land areas, for the realization of most of the fodder within the unit, thus having the fewest inputs. The problem of this system is also one related to sustainability in relation to environmental protection and the permanent assurance of quality products and integration into the food chain.

ACKNOWLEDGMENTS

This research work was carried out with the support of the University of Agronomic Sciences and Veterinary Medicine of Bucharest and also, was funded by PhD Project "Research on the economic efficiency of beef and dairy cattle farms, depending on the size of the farm and the farming system".

REFERENCES

Dinu, I.D. (1996). *Animals and humanity*, Bucharest, RO: Agricultural Technique Publishing House.
Georgescu, G. (1988). *Cattle breeding dissertation*, Vol. I, Bucharest, RO: Ceres Publishing House.
Georgescu, G. (1989). *Cattle breeding dissertation*, Vol. II, Bucharest, RO: Ceres Publishing House.
Irimia, E., Cziszter, L.T., Grigore, D.M., Gavojdian, D., Bărăităreanu, S., Vidu, L. (2021). Analysis of calf management practices in different dairy cattle farms, *Scientific Papers. Series D. Animal Science, LXIV*(2), 238-246.
Iordan, I. (1992). *The surroundings of Bucharest*, Bucharest, RO: Society „R" Publishing House.
Oancea, M. (2003). *Modern management in agricultural holdings*, Bucharest, RO: Ceres Publishing House.
Pană, C. (2005). *Feeding dairy cows*, Practical workbook USAMV Bucharest.
Popescu, A. (2005). *Financial Accounting*, Bucharest, RO: University Book Publishing House.
Popescu, A. (2007). *Accounting and financial analysis in agricultural companies*, Bucharest, RO: Dominor Publishing House.
Vidu, L. (2002). Research on the exploitation of dairy cows in standard modules for the private sector, Doctoral thesis, USAMV Bucharest, RO.