RESEARCH ARTICLE **(Open Access)**

The impact of nutrition on milk production and weight of newborn calves

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Abstract

Milk production mainly from the caws varies in different areas of Albania. In field areas, productivity has grown as a result of the increasing number of caws, the increase in productivity and improvement of basic food. Feeding according to stages is a programme that includes herd feeding in time periods based on the milk productivity level, fat quantity in milk, food quantity consumed and the weight of the animal alive. Farm producers need to draft food rations in a way so that can fulfill animals need in each of these stages for an optimal production, to minimize or avoid metabolic anomalities, to increase animals lifetime and the profit from animal herd. The main purpose of this study is the usage of contemporary methods in the economic analyses of utilizing resources, materialized in small domestic farms. The study took place in "Agrotex'' farm in Lushnje district. The data was analysed and processed according to nutrition stages (1-up to 150 days of lactation, 2-over 150 days of lactation and 3-withering period) milk yield and calves weight on birth for a period of 6 years. In addition to nutrition stages, the data was analysed and processed also for milk yield and calves weight on birth. The study utilizes the method of approximation of undetermined variables to solve restriction systems, as well as Cobb-Douglas production function to analyse the impact of food portion components on milk production. This study proves that balance nutrition makes up for the primary factor to increase the effectivity of economic farms.

Keywords: optimal structure, milk production, nutrition, approximation with the method of undetermined variables, food portion.

Introduction

This study publishes the economic analyses of the impact of three nutrition factors – moisture food, dry food and concentrate — in 2 outputs: milk yield and the average weight of inborn calves, as well as the use of production function in agricultural sector.

The main purpose of this study is to use contemporary methods in the economic analyses of resource usage, all this made concreate in a livestock complex.

Milk production mainly from the caws varies in different areas of Albania. Nowdays the sustainable development of agricultural farms and especially of livestock farms requires product optimization and at the same time the continuous analyses of economic and techinical impact factors.

The production function used during the study is that of Cobb-Douglas and it aims to analyse the impact of the three impact nutrition factors on caw's milk production and on the average weight of newborn calves. To be successful, dairy producers must master all aspects of dairy management. Proper dry cow nutrition and management is critical, since decisions made during this period will have a tremendous impact on milk production and health during the next lactation [9]. This study proves once more that using cattle volume nutrition system in our country's conditions makes up the primary factor for increasing the economic effectivity of farms. At the end of the study it is proved that the maximal income and profits in cattle farms are reached at the same point of route expansion where the cost is minimal.

Materiali dhe metoda

The production function forms for milk and the average weight of in born calves are determined.

The suitability of selected models is proved.

The optimal combination of inputs (food ration structure) to maximize gain and minimize costs is discovered.

It is used the approximation method by using the undetermined coeficinents to solve the system of margins and to determine the optimal structure of milk production.

It is used the method of linear regression to determine the parameters of the model through the packet of econometric computerized programmes SPSS.

- After deciding on options through estimates it is calculated the correct solution based on MAPLE programme.

The livestock complex studied for this purpose was “Agrotex” in the field area of Tre Ura village, Grabian commune, Lushnje disctrict. The data of feeding through stages was analysed and processed (1- up to 150 days of lactation, 2- over 150 days of lactation and 3- dry period), as well as data on milk yield and the average weight of newborn calves. These data were analysed for a six-year period (2008-2013 period).

In order to realize a more accurate dependance of the newborn calves’ weight and milk quantity from inputs (food) it is procedeed according months. The average values of milk yield and average quantity of food were grouped thoughout a year (per months) according to the 3 stages of caw treatment, as well as the average weight of newborn calves.

After data processing there were built concreate functions, milk yield analyses and the average weight of newborn calves was undertaken after data processing in relation to the three production functions (moisture, dry and concentrate food).

The average prices for respectively 1 kg of moisture food, 1 kg of dry food and 1 kg of concentrate are 3,8 L; 4,8 L and 15,2 L.

The production function was requested in the following form $y = Ax_1^{\alpha} x_2^{\beta} x_3^{\gamma}$

The appeal of the Cobb-Douglas type of function rests largely with its simplicity [4].

Linear regression method was used to determine $\log A, \alpha, \beta \; dhe \; \gamma$ through the econometric computerized programmes SPSS, from which resulted that the models are suitable. We can save predicted values, residuals, and other statistics useful for diagnostics. Each selection adds one or more new variables to your active data file [11].

It came out that the models were appropriate. The presence of association does not necessarily imply causation. Statistical tests can only establish whether or not an association exists between

Variables [15]. It is confirmed the hypothesis for the importance general regression and shown that at least one of the variables provides information for prognosis of y [2]. Based on these data, the folllowing production functions were built:

$$y_1 = 39.1343266 \cdot x_1^{0.290} \cdot x_2^{0.126} \cdot x_3^{0.174}$$
$$y_2 = 0.309127953 \cdot x_1^{0.317} \cdot x_2^{0.131} \cdot x_3^{0.126}$$

where x_1, x_2, x_3 y_1 and y_2 show respectively the amount of moisture, dry and concentrate food, average milk production and the average weight of newborn calves.

Profit maximization

As in the single product case, the mathematics of profit maximization can be approached as either a constrained optimization problem or unconstrained optimization problem formulated by substituting the explicit form of the production function into the profit function for x [1]. For profit maximization we have asserted the profit function:

$$F = p_1 f(x_1, x_2, x_3) + p_2 g(x_1, x_2, x_3) - r_1 x_1 - r_2 x_2 - r_3 x_3$$

Also, we have asserted the necessary conditions for profit maximization.

$$\frac{\partial F}{\partial x_1} = p_1 f_{x_1}^{'}(x_1, x_2, x_3) + p_2 g_{x_1}^{'}(x_1, x_2, x_3) - r_1 = 0$$
$$\frac{\partial F}{\partial x_2} = p_1 f_{x_2}^{'}(x_1, x_2, x_3) + p_2 g_{x_2}^{'}(x_1, x_2, x_3) - r_2 = 0$$
$$\frac{\partial F}{\partial x_3} = p_1 f_{x_3}^{'}(x_1, x_2, x_3) + p_2 g_{x_3}^{'}(x_1, x_2, x_3) - r_3 = 0$$

Thus we have to solve the system (*)

$$\begin{cases} p_1\alpha\, y_1 + p_2 a y_2 = r_1 x_1 \\ p_1\beta\, y_1 + p_2 b y_2 = r_2 x_2 \\ p_1\gamma\, y_1 + p_2 c y_2 = r_3 x_3 \\ y_1 = A x_1^{\alpha} x_2^{\beta} x_3^{\gamma} \\ y_2 = B x_1^{a} x_2^{b} x_3^{c} \end{cases} \qquad (*)$$

Technically it is difficult to find the accurate solution of the system (*), thus we have found close solutions with a satisfying estimate through the method of undetermined coeficients, that has made possible determining the areas where y_1 and y_2 move. Theorem presents a method for using polynomials to approximate functions that cannot be evaluated [7]. To solve systems of equations numerically, one can use the f solve (float solve) command [10]. These areas have served as options to find the accurate solution of the system (*) based on MAPLE programme.

Remember that: $\alpha = 0.290,\ \beta = 0.126,\ \gamma = 0.174,\ a = 0.317,\ b = 0.131,\ c = 0.126,$

$p_1 = 37.5$, $p_2 = 350$, $r_1 = 7.4$, $r_2 = 7.6$, $r_3 = 16.5$.

According to this method, the continuous function is given $y = f(x)$ in [a,b]

where, segment [a,b] is divided through n+1 points $x_0, x_1, \ldots x_n$, where $x_0 = a$ and $x_n = b$.

If we use x_C as the center of fraction**,** then the average value of the function on point m of dividing the segment [a,b] would give the following equation $f(x_m) = \sum_{i=0}^{n} A_i G_i (x_m - x_C)$ where

$G_0(x_m - x_C) = 1,$

$G_1(x_m - x_C) = (x_m - x_C)$

....

$G_i(x_m - x_C) = (x_m - x_C)^i$

whereas the coeficient A_i will be determined. Using this method in approximating our functions we will have to solve first these equation systems in order to determine the values of A_i variables.

For milk production function $y_1 = 39.1343266 \cdot x_1^{0.290} \cdot x_2^{0.126} \cdot x_3^{0.174}$ we act as below .

For $x_1^{0.290}$ we will have :

$A_0 + A_1 (9900 - x_C) + A_2 (9900 - x_C)^2 + A_3\, 9900 - x_C)^3 = 9900^{0.290}$

$A_0 + A_1 (9950 - x_C) + A_2 (9950 - x_C)^2 + A_3 (9950 - x_C)^3 = 9950^{0.290}$

$A_0 + A_1 (10050 - x_C) + A_2 (10050 - x_C)^2 + A_3 (10050 - x_C)^3 = 10050^{0.290}$

$A_0 + A_1 (10100 - x_C) + A_2 (10100 - x_C)^2 + A_3 (10100 - x_C)^3 = 10100^{0.\,0.290}$

There is x_C = 10000. Coeficient values will be accordingly

$A_0 = 14.45439771$, $A_1 = 0.0004191776$, $A_2 = -0.14881 \cdot 10^{-7}$, $A_3 = 0.84 \cdot 10^{-12}$

Then we will find that :

$x_1^{0.290} \approx 14.45439771 + 0.0004191776(x_1 - 10000) - 0.14881 \cdot 10^{-7}(x_1 - 10000)^2 +$
$0.84 \cdot 10^{-12} (x_1 - 10000)^3$

For $x_2^{0.126}$ we have that x_C = 5350. Coeficient values will be respectively

$A_0 = 2.949664198$, $A_1 = 0.0006946871$, $A_2 = -0.56755 \cdot 10^{-8}$, $A_3 = 0.664 \cdot 10^{-12}$

And then we will find that :

$x_2^{0.\,126} \approx 2.949664198 + 0.0006946871 (x_2 - 5350) - 0.56755 \cdot 10^{-8} (x_2 - 5350)^2 +$
$0.664 \cdot 10^{-12}(x_2 - 5350)^3$.

For $x_3^{0.174}$ we have that x_C = 1780. Coeficient values will be respectively

$A_0 = 3.677672740$, $A_1 = 0.0003595028$, $A_2 = -0.83424 \cdot 10^{-7}$, $A_3 = 0.285 \cdot 10^{-10}$

Then we will find that :

$x_3^{0.174} \approx 3.677672740 + 0.0003595028\,(x_1 - 1780) - 0.83424 \cdot 10^{-7}\,(x_1 - 1780)^2$
$+ 0.285 \cdot 10^{-10}\,(x_1 - 1780)^3$

This way, milk production function is average with the polynomial function as follows .

$y_1 \approx 39.1343266\,[\,10.26262171 + 0.0004191776\,x_1 - 0.14881 \cdot 10^{-7}\,(x_1 - 10000)^2 + 0.84 \cdot 10^{-12}$
$(x_1 - 10000)^3][\,2.578006600 + 0.00006946871\,x_2 - 0.56755 \cdot 10^{-8}(x_2 - 5350)^2 + 0.664 \cdot 10^{-12}$
$(x_2 - 5350)^3][\,3.037757756 + 0.0003595028\,x_3 - 0.42747 \cdot 10^{-7}\,(x_3 - 1780)^2 + 0.285 \cdot 10^{-10}$
$(x_3 - 1780)^3]$

For meat production function of calves $y_2 = 0.309127953 \cdot x_1^{0.317} \cdot x_2^{0.131} \cdot x_3^{0.126}$ we act as below .

For $x_1^{0.317}$ we have that x_C = 10000. Coeficient values will be respectively

$A_0 = 18.53531623$, $A_1 = 0.0005875698$, $A_2 = -0.20066 \cdot 10^{-7}$, $A_3 = 0.110 \cdot 10^{-11}$

Then we will find that :

$x_1^{0.317} \approx 18.53531623 + 0.0005875698\,(x_1 - 10000) - 0.20066 \cdot 10^{-7}\,(x_1 - 10000)^2 +$
$0.110 \cdot 10^{-11}\,(x_1 - 10000)^3$

For $x_2^{0.131}$ we have that x_C = 5350.Coeficient values will be respectively

$A_0 = 3.079033016$, $A_1 = 0.00007539315$, $A_2 = -0.61242 \cdot 10^{-8}$, $A_3 = 0.712 \cdot 10^{-12}$

Then we will find that :

$x_2^{0.131} \approx 3.079033016 + 0.00007539315\,(x_2 - 5350) - 0.61242 \cdot 10^{-8}\,(x_2 - 5350)^2 +$
$0.712 \cdot 10^{-12}\,(x_2 - 5350)^3$.

For $x_3^{0.126}$ we have that x_C = 1780. Coefficient values will be respectively

$A_0 = 2.567751080$, $A_1 = 0.0001817622$, $A_2 = -0.44630 \cdot 10^{-7}$, $A_3 = 0.1560 \cdot 10^{-10}$

Then we will find that :

$x_3^{0.126} \approx 2.567751080 + 0.0001817622\,(x_3 - 1780) - 0.44630 \cdot 10^{-7}\,(x_3 - 1780)^2$
$+ 0.1560 \cdot 10^{-10}\,(x_3 - 1780)^3$

In this way, the polynomial function of meat production for calves is as follows .

$y_2 \approx 0.309127953\,[\,12.65961823 + 0.0005875698\,x_1 - 0.20066 \cdot 10^{-7}\,(x_1 - 10000)^2$
$+ 0.110 \cdot 10^{-11}\,(x_1 - 10000)^3][2.675679664 + 0.00007539315\,x_2 - 0.61242 \cdot 10^{-8}\,(x_2 - 5350)^2 + 0.712 \cdot 10^{-12}\,(x_2 - 5350)^3][\,2.244214364 + 0.0001817622\,x_3 - 0.44630 \cdot 10^{-7}\,(x_3 - 1780)^2 + 0.1560 \cdot 10^{-10}\,(x_3 - 1780)^3]$

After determining the coefficients, the system was solved (*), by replacing the respective estimates in the last two equations, i.e. in solving the following system:

$10.8750\,y_1 + 110.950\,y_2 = 7.4\,x_1$
$4.7250\,y_1 + 45.850\,y_2 = 7.6\,x_2$
$6.5250\,y_1 + 44.100\,y_2 = 16.5\,x_3$
$y_1 \approx 39.1343266\,[\,10.26262171 + 0.0004191776\,x_1 - 0.14881 \cdot 10^{-7}\,(x_1 - 10000)^2 + 0.84 \cdot 10^{-12}$
$(x_1 - 10000)^3][\,2.578006600 + 0.00006946871\,x_2 - 0.56755 \cdot 10^{-8}(x_2 - 5350)^2 + 0.664 \cdot 10^{-12}$
$(x_2 - 5350)^3][\,3.037757756 + 0.0003595028\,x_3 - 0.42747 \cdot 10^{-7}\,(x_3 - 1780)^2 + 0.285 \cdot 10^{-10}$
$(x_3 - 1780)^3]$
$y_2 \approx 0.309127953\,[\,12.65961823 + 0.0005875698\,x_1 - 0.20066 \cdot 10^{-7}(x_1 - 10000)^2 + 0.110 \cdot 10^{-11}$
$(x_1 - 10000)^3][\,2.675679664 + 0.00007539315\,x_1 - 0.61242 \cdot 10^{-8}(x_2 - 5350)^2 + 0.712 \cdot 10^{-12}$
$(x_2 - 5350)^3][\,2.244214364 + 0.0001817622\,x_3 - 0.44630 \cdot 10^{-7}\,(x_3 - 1780)^2 + 0.1560 \cdot 10^{-10}$

(x_3 – 1780)^3]

Accurate solutions through MAPLE programme which are the following values for x_1, x_2, x_3, y_1 and y_2. (x_1 = 10327.55555, x_2 = 4355.025298, x_3 = 2717.384717, y_1 = 6565.500013,

y_2 = 45.28254528).

Table 1. Estimates through constant variables

Moisture food x_1	Dry food x_2	Concentrate x_3	From Solution		The calculated value		Changes for	
			Milk yield y_1	Calves weight y_2	y_1	y_2	y_1	y_2
10327.5556	4355.0253	2717.38472	6565.50001	45.2825453	6481.558241	43.84281007	-2.075372	-0.01482632

The table shows that despite the way of approximation, the area where inputs and outputs vary are as below : $x_1 \in [9000,12000]$, $x_2 \in [3000,5000]$, $x_3 \in [2000,3000]$, $y_1 \in [5000,7000]$, $y_2 \in [30,60]$.

Through MAPLE, the accurate results are :

x_1 = 10138.85488 , x_2 = 4274.822552, x_3 = 2664.967899 , y_1 = 6424.816564 , y_2 = 46.48621873 .

Lets see the fulfillment of necessary conditions for profit maximization. In order to do this we need to determine the sign of Hessian determineras well as its main minors. The necessary conditions for profit maximization require that main minors leading Hessian determiner should be alternated in sign, starting with a negative sign to the first order minor. That is:

$|H_1|$ = -0.0005168498447 <0.

Lets assess the determiner

$$|H_2| = \begin{vmatrix} -0.0005168498447 & 0.0002187093167 \\ 0.0002187093167 & -0.001553259003 \end{vmatrix} = 0.7549679093 \cdot 10^{-6} > 0$$

$$|H_3| = \begin{vmatrix} -0.0005168498447 & 0.0002187093167 & 0.0004739953505 \\ 0.0002187093167 & -0.001553259003 & 0.0004872357064 \\ 0.0004739953505 & 0.0004872357064 & -0.00512882000 \end{vmatrix} = -0.3298773188 \cdot 10^{-8} < 0$$

We have proved that $|H_1| < 0$, $|H_2| > 0$, $|H_3| < 0$ i.e. profit maximization will be achieved for the values x_1, x_2 and x_3 that solve the system (*).

Conditioned cost minimization

The following function are given

$$y_1 = Ax_1^{\alpha} x_2^{\beta}, x_3^{\gamma},\ y_2 = Bx_1^{a} x_2^{b}, x_3^{c}.$$

$$y_1 = f(x_1, x_2, x_3),\ y_2 = g(x_1, x_2, x_3).$$

Lets sign r_1, r_2 and r_3 accordingly input prices x_1, x_2 and x_3, and then with p_1 and p_2 output prices respectively y_1 and y_2. If S is the set of all points (x_1, x_2) that satisfy a number of equations we have the Lagrangean problem of maximizing or minimizing a function subject to equality constraints [5]. Each solution (x_1, x_2, λ) gives a candidate (x_1, x_2) for an extreme point. We can finally compare the values of function at these candidate points to ascertain where its maximum and minimum values on S are attained [8]. We can deal with optimization problems with two or more constraints simply by using two or more Lagrange multipliers [6].

For the minimum of cost we have formed Lagrange function LC

$$LC = r_1x_1 + r_2x_2 + r_3x_3 + \lambda_1[y_1 - f(x_1, x_2, x_3)] + \lambda_2[y_2 - g(x_1, x_2, x_3)]$$

where λ_j is Lagrange multiplier, accompanied with the function of production for y_j, j=1,2.

And we have expressed the necessary conditions for the minimum of LC :

$$\frac{\partial LC}{\partial x_1} = r_1 - \lambda_1 f'_{x_1}(x_1, x_2, x_3) - \lambda_2 g'_{x_1}(x_1, x_2, x_3) = 0$$

$$\frac{\partial LC}{\partial x_2} = r_2 - \lambda_1 f'_{x_2}(x_1, x_2, x_3) - \lambda_2 g'_{x_2}(x_1, x_2, x_3) = 0$$

$$\frac{\partial LC}{\partial x_3} = r_3 - \lambda_1 f'_{x_3}(x_1, x_2, x_3) - \lambda_2 g'_{x_3}(x_1, x_2, x_3) = 0$$

$$\frac{\partial LC}{\partial \lambda_1} = y_1 - f(x_1, x_2, x_3) = 0$$

$$\frac{\partial LC}{\partial \lambda_2} = y_2 - g(x_1, x_2, x_3) = 0$$

This determinant, often referred to as a bordered Hessian, shall be denoted by |H¯ |, where the bar on top symbolizes the border [12]. And after we have assessed the necessary conditions for the minimum through bordered Hessian determiner we have proved that the cost function has a minimum for the values of x_1 and x_2 shown in the equations (**).

$$\begin{cases} x_1 = \left[\left(\frac{y_1}{A}\right)^b \left(\frac{B}{y_2}\right)^\beta x_3^{\beta c - \gamma b} \right]^{\frac{1}{\alpha b - \beta a}} \\ x_2 = \left[\left(\frac{y_2}{B}\right)^\alpha \left(\frac{A}{y_1}\right)^a x_3^{\gamma a - \alpha c} \right]^{\frac{1}{\alpha b - \beta a}} \end{cases} \quad (**)$$

$$r_1(\gamma b - \beta c)\left[\left(\frac{y_1}{A}\right)^b \left(\frac{B}{y_2}\right)^\beta x_3^{\beta c - \gamma b} \right]^{\frac{1}{\alpha b - \beta a}} + r_2(\alpha c - \gamma a)\left[\left(\frac{y_2}{B}\right)^\alpha \left(\frac{A}{y_1}\right)^a x_3^{\gamma a - \alpha c} \right]^{\frac{1}{\alpha b - \beta a}} = r_3(\alpha b - \beta a)x_3$$

$$\begin{cases} \lambda_1 = \dfrac{r_1 b x_1 - r_2 a x_2}{(\alpha b - \beta a) y_1} \\ \lambda_2 = \dfrac{r_2 \alpha x_2 - r_1 \beta x_1}{(\alpha b - \beta a) y_2} \end{cases}$$

It is found that $x_1 = 10138.85$ ($x_1 = 10138.85440$), $x_2 = 4274.82$ ($x_2 = 4274.822688$), $x_3 = 2664.97$ ($x_3 = 2664.967932$), $\lambda_1 = 37.50$ ($\lambda_1 = 37.50006329$), $\lambda_2 = 349.99$ ($\lambda_2 = 349.9917827$)

In brackets it is given the value of three figures after the decimal place. These estimates were used in the MAPLE programme.

It is known that the necessary conditions for minimizing the costs is required through the main minor signsof Hessian determiner in the margin.

x_1 = 10138.85440, x_2 = 4274.822688, x_3 = 2664.967932, y_1 = 6424.816564, y_2 = 46.48621873

$\lambda_1 = 37.50006329,\ \lambda_2 = 349.9917827$. (a)

Lets assess the necessary conditions for the minimum through Hessianit determiner with the margin.

$$\left|\overline{H}\right| = \begin{vmatrix} 0 & 0 & 0.1837679811 & 0.1893708690 & 0.4194865044 \\ 0 & 0 & 0.1329637738\cdot10^{-2} & 0.1370176961\cdot10^{-2} & 0.3035159246\cdot10^{-2} \\ 0.1837679811 & 0.1329637738\cdot10^{-2} & 0.5168498544\cdot10^{-3} & -0.2187092935\cdot10^{-3} & -0.4739955452\cdot10^{-3} \\ 0.1893708690 & 0.1370176961\cdot10^{-2} & -0.2187092935\cdot10^{-3} & 0.1553259074\cdot10^{-2} & -0.4739955452\cdot10^{-3} \\ 0.4194865044 & 0.3035159246\cdot10^{-2} & -0.4739955452\cdot10^{-3} & -0.4739955452\cdot10^{-3} & 0.5127990506\cdot10^{-2} \end{vmatrix}$$

Since $\left|\overline{H}\right| = 0.1\cdot10^{-27} > 0$ then we proved that cost function has a minimum for x_1, x_2 and x_3 shown in equation (a). The values y_1 and y_2 are in the production level for which the cost will be minimal.

The change of input values in 365 days for profit maximization and cost minimization are almost unnoticed. This shows that profit maximization and cost minimization is achieved for the same input values.

We have proved that profit maximization and cost minimization is achieved for x_1 =10138.85488 moisture food , x_2 = 4274.822552 dry food and x_3 = 2664.967899 kg concentrat. Iin this case the amount of milk produced by a caw will be 6424.816564 kg while the average weight of newborn caws will be 46.48621873 kg. It is proved that the maximum profit and maximum revenue achieved in the same point of the expansion path where the cost is minimal [3].

Food amount per year :

Moisture food quantity = 10138.85 kg .

Dry food quantity = 4274.82 kg .

Concentrate food = 2664.97 kg .

Cost = 10138.85 · 7.4 + 4274.82 · 7.6 + 2664.97 · 16.5 = 151488.15 L.

Income = 6424.82 · 37.5 + 46.49 · 350 = 257200.8 L.

Thus, the profit from a caw will be 105712.6 L per year.

Conclusions

The following conclusions are attained from the sudy:

During the process of decision-making it is becoming always more evident that it is necessary to make detailed scientific researches. Thus, the realization of livestock production necessitates the analyses of inputs in production.

Applying Cobb-Douglas production functions gives the opportunity to realize economic analyses of farms for milk caws breeding.

The study proved that for average production levels (21.25115 kg milk per day) the most optimal structure would be: 59% moisture food, 31% dry food, 10% concentrate.

If the theoretical arguments concerning the relative effectiveness of different economic systems are subject to empirical testing, it is necessary to do some current estimates of effectiveness indicators [13]. In the general case, it is showed that maximum income is obtained for the same input amount where the maximum profit is reached [14].

In conclusion, based on our country's conditions, volume system nutrition is prefered.

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