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Foreign Evaluation Of Fodders Feeding Power And Ration For In Milk Cows Under Conditions Of Zao Manino Of The Kalacheevsky District Of The Voronezh Region.

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ABSTRACT

On the basis of the traditionally used feed nutrient parameters that take into account raw, digestible nutrients and exchange energy (EE), such foreign indices as pure lactation energy, assimilated protein, nitrogen balance in rumen in a siloed alfalfa mass. A comparative analysis of these indices, obtained by calculation with the data presented by the laboratory Eurofins BLGG AgroXpertus, was made. On the example of a particular farm, the need of cows in dry matter, Pure Lactation Energy, digestible protein, Balance of Nitrogen in rumen for cows of different physiological state and productivity, live weight 600 kg, fat content 3.6% and protein 3.0% is considered. The principle of making rations in the dairy enterpise according to the accepted European system, which includes three parts of the ration: the main food, balancing and productive mixed fodder, is considered. In the main diet, calculated for the productivity of 14 kg of milk concentrated fodder is 10%, a cow with milk yield of 36 kg consumes ≈ 50% of concentrates according to the EFU (energu feed units), which corresponds to 7,16 and 38,85% on dry matter. In the late dead, the cows' diet is balanced in the direction of acid elements, for this purpose, a premix with anionic salts is included in the diet, which positively affects the parathyroid gland, contributes to the release of parathyroid hormone, as a result of which calcium is absorbed from the feed, which prevents parental paresis. When the anion premix is added on, the value of the cation of the anion balance becomes negative and amounts to (-298) mEq / kg, against the diet without using anionic salts of 180 mEq / kg.

Keywords: pure lactation energy; assimilated protein; nitrogen balance in the rumen; feeding of in mik cows; foreign nutritional indices; anionic salts; the main feed, the productive and balancing feed, the magnitude of the cation-anion balance.

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INTRODUCTION

World experience shows that livestock productivity is due to the genotype, feeding and housing conditions. At the same time, the growth of milk production of cows to milk yield of 4000 kg of milk per year depends mainly on the full balanced feeding. With a yield of more than 4500 kg, the value of the genetic potential increases, but even in this case feeding remains crucial for 65-70% [1, 3, 7, 5, 23].

The higher the quality of the harvested main fodders, the more cattle eat them and the higher the milk yield. Highly productive cows can produce 4000-5000 kg of milk per year, using only high-quality roughage. Therefore, the economic efficiency of increasing the productivity of animals is to increase the energy value of the main feed while optimizing the fiber content in it. The diet should be balanced by 22-30 indices. It must meet the standards in energy and nutrients, the ratio between the elements of diet [9, 12, 11, 13, 17].

At present time in addition to the traditionally used system that takes into account raw, digestible nutrients and exchange energy (EE), other systems are currently used to balance diets: NRC, CVB, DLG.

So in the CVB system use the following indices:

- net lactation energy (NEL)
- digested protein (nXP)
- nitrogen balance in the rumen (RNB)

To determine the above indices there are two ways:

- send feed to the laboratory where these indices are recorded in the protocols. In recent years, an increasing number of Russian farms have sent feed samples to the Euroofins BLGG AgroXpertus laboratory. The analysis of feeds carried out in the BLG laboratory is universal and reflects the nutritional indicators used in different systems for assessing the quality of feed and rations.

- calculate yourself [6, 8, 19].

MATERIALS AND METHODS

The work was carried out in the conditions of ZAO “Manino” of the Kalacheevsky district of the Voronezh region, which is located in the village of Manino on cows of the Simmental breed.

In the process of writing the work we were assigned the following tasks:

- consider an example of calculating the energy of lactation (NEI), assimilated protein (nXP), nitrogen balance in the rumen (RNB) in the ensiled alfalfa mass, compare the data with the BLGG laboratory protocols;
- to consider the need of cows for dry matter, Pure Lactation Energy, assimilable protein, Nitrogen Balance in the Rumen of cows of different physiological status and productivity, 600 kg live weight, 3,6% fat content and 3,0% protein;
- to consider the principle of making rations in the farm according to the adopted European system, which includes three parts of the diet: the main feed, balancing and productive all-mash;
- to consider the main parameters of the analysis of rations on the Russian and foreign systems;
- to trace the need for the inclusion of the premix with anionic salts of cows in the late deadwood according to the scheme presented in table 1.

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Table 1 - Research Scheme

Groups		Rations
Control	Deadwood 2	Corn silage 18 kg; ceral hay 2 kg; Barley straw 2 kg; sunflower cake 0,57 kg; cake of rape 1,2 kg; wheat 0,45 kg; barley 0,45 kg; chalk feed 0,12 kg
	Lactating first 60 days	Senge Alfalfa 15,8; corn silage 20,9; ceral hay 3,4; Barley straw 1; feed balancing 1,4; Compound feed productive 10,1 kg
Experienced	Deadwood 2	Corn silage 18 kg; ceral hay 2 kg; Barley straw 2 kg; sunflower cake 0,57 kg; cake of rape 1,2 kg; wheat 0,45 kg; barley 0,45 kg; chalk feed 0,12 kg; premix with anionic salts 0,2 kg
	Lactating first 60 days	Senge Alfalfa 15,8; corn silage 20,9; ceral hay 3,4; Barley straw 1; feed balancing 1,4; Compound feed productive 10,1kg

- to calculate the economic efficiency of the use of anionic premixes.

RESULTS

The paper considers the calculation of the net energy of lactation (NEL), assimilated protein (nXP), nitrogen balance in the rumen (RNB) in the ensiloed mass of alfalfa harvested in ZAO Manino of the Kalacheevsky district of the Voronezh region.

NEL is a part of the energy of the feed that is spent on life support, milk production or growth.

The net energy of lactation is calculated by the formula (formula VAN ES), which is used in the Netherlands, Belgium, France, Switzerland, Austria [2, 4, 20, 21].

$$PEL\ (MJ) = 0,6 * (1 + 0,004 * (q - 57)) * MA\ (MJ),$$

where $q\ (\%) = EE / TE * 100$,

NEL - pure lactation energy
EE - exchange energy
GE - gross or total energy

The exchange energy for ruminants can be calculated by the formula:

$$EE\ (kJ) = 31,2 * \text{digestible crude fat (g)} + 13,6 * \text{digestible crude fiber (g)} + 14,7 * \text{residue of digestible organic matter (g)} + 2,34 * \text{crude protein (g)}$$

The remainder of the digestible organic matter (RDOM) = digestible organic matter - digestible crude fat - digestible crude fiber.

The gross energy of the feed (to determine the coefficient q) is calculated by the formula:

$$GE\ (kJ) = 23,9 * \text{crude protein} + 39,8 * \text{crude fat} + 20,1 * \text{crude fiber} + 17,5 * \text{nitrogen-free extraction substances NFES (g)}$$

The calculation of gross and exchange energy in the green mass of alfalfa according to the above formulas is conveniently presented in the form of table 2.

$$q\ (\%) = EE / GE * 100 = 8,66 / 18,12 * 100 = 47,79\%$$

$$NEL\ (MJ) = 0,6 * (1 + 0,004 * (q - 57)) * EE\ (MJ) = 0,6 * (1 + 0,004 * (47,79 - 57)) * 8,66 = 5, 0$$

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Table 2 - Calculation of gross and exchangeable energy

Indicators	Raw materials, g	Prevalence,%	Digestible raw matter, g	Gross energy, kJ / kg	Gross energy, MJ / kg	Exchange energy, MJ / kg
Organic matter	894	63	563,22			
Crude protein	153			3656,70	3,66	0,36
Raw fat	32	36	11,52	1273,60	1,27	0,36
Crude Fiber	302	49	147,98	6070,20	6,07	2,01
SWN	407			7122,50	7,12	
RDOM			403,72			5,93
Total for GE and EE					18,12	8,66

Organic mass = Raw organic mass * digestibility coefficient = 894 x 63/100 = 563.22

The remainder of the digestible organic mass (RDOM) = digestible organic mass - digestible raw fat - digestible crude fiber = 563,22 – 11,52 – 147,98 = 403,72.

Digested protein (nXP) consists of microbial protein, which is formed in the rumen, and non-cleavable protein in the rumen. It shows how much protein will be available in the small intestine and, at the same time, it takes into account the energy available in the feed and the amount of protein not digested in the rumen. The rate of digested protein is a calculated value.

According to the literature, we determine how much non-cleavable protein is contained in the feed: In the green mass of alfalfa at the end of flowering 25%. UDP = CP * OPP (%) / 100 = 153 * 25 (%) / 100 = 38,25 g

Using the regression equation, we determine the amount of protein absorbed in the small intestine from the content in the feed of raw protein, metabolizable energy and non-digestible protein:

nXP = (11,93-6,82 * UDP / CP) * OE + 1,03 * UDP = (11,93-6,82 * 38,25 / 153) * 8,66 + 1,03 * 38,25 = 127,95

The nitrogen balance in the rumen (RNB) is a measure of the supply of nitrogen to the rumen bacteria, taking into account the energy contained in the feed.

If the nitrogen balance in the rumen is negative, this indicates a lack of nitrogen. If the nitrogen balance in the rumen is positive, this indicates either sufficient supply of nitrogen (RNB) indicator from 1 to 50) or an excess of nitrogen (above 50) and the threat of alkalosis (above 100).

You can determine the nitrogen balance of the feed as the difference between the raw protein and the digested protein divided by 6.25.

RNB = (CP-nXP) / 6,25 = (153-127,95) / 6,25 = 4.

Thus, the data obtained as a result of our calculations correspond to the indicers presented by the Euroofins BLGG AgroXpertus laboratory.

The nutritional needs of cows depend on their body weight and productivity. In our work, using the example of a specific farm, we examined the cows need for dry matter, Pure Lactation Energy, assimilable protein, and also took into account the Nitrogen Balance in the Rumen for cows with a live weight of 600 kg, a fat content of 3,6% and protein 3% in the formulas below.

The need for dry matter

The maximum amount of consumed dry matter is from 3 to 3,5% of the live weight of the animal and, depending on the breed of the animal, lies between 18 and 26 kg.

For our farm, the maximum dry matter, in kg = 3,5% x LM = 3,5 x 600 kg / 100 = 21 kg DS

Energy demand

Total energy consists of the sum of the energy of life and the energy of productivity.

The need for life support:

The need for life is calculated by the following formula:

NEL life (MJ /head Per day) = 0.293 x LM to 0,75 degree

where LM in the 0.75 degree is the metabolic body weight in kilograms.

In our example, the need for energy to sustain life is:

Nell life (MJ / head. Per day) = 0.293 MJ x kg LM to the degree 0.75 = 0.293 MJ x kg 600 to the degree 0,75 = 35,5 MJ

The need for productivity:

The formula for calculating the energy demand for productivity:

NELproductivity (MJ / kg of milk) = 1,05 + (0,38 x F%) + (0,21 x P%),

where F% is the fat content in milk, and P% is the protein content in milk, in%

In our example, the need for energy productivity is for a cow with a yield of 16 kg:

NELproductivity (MJ / kg of milk) = 1.05 + (0,38 x F%) + (0,21 x P%) = 1,05 + (0,38 x 3,6%) + (0,21 x 3,0%) = 3,048 MJ NEL per kg of milk

Thus, for productivity (16 kg) a cow needs 16 x 3.048 = 48.8 MJ NEL

Total energy (MJ NEL / head per day) = 35,5 + 48,8 = 84,3

Energy requirement for dry cows

In dry cows in the last weeks of pregnancy there is an additional need for energy for increased fetal growth:
The need for energy in the dry period:

from 6 to 4 weeks before calving: the need for life + 13 MJ people / head per day

from 3 weeks to calving: the need for life + 18 MJ per person / head per day

In our example:

from 6 to 4 weeks before calving: 35,5 + 13 = 48,5 MJ NEL / head per day

from 3 weeks to calving: 35,5 + 18 MJ = 53,5 MJ NEL / head per day

Protein requirement

nXP-total need (g / head per day) = nXP need for life + nXP need for productivity.
The need for assimilated protein to maintain life is determined by the formula:

nXP life (g / head. Per day) = (431 x 1,05) + (LM - 650) / 2,5

LM is a live weight in kilograms

In our example:

nXP life (g / head. Per day) = (431 x 1.05) + (LM - 650) / 2,5 = (431 x 1,05) + (600 - 650) / 2,5 = 433 g / head in a day

The need for assimilated protein for the production of 1 kg of milk is determined by the formula:

nXP milk (g / kg milk) = (81 x 1,05) + (10 x P% - 34) x 2,1

where P% is the protein content in milk,%

In our example:

nXP milk (g / kg milk) = (81 x 1.05) + (10 x B% - 34) x 2.1 = (81 x 1.05) + (10 x 3.0 - 34) x 2, 1 = 76.65 g / kg milk

For a given productivity (16 kg) a cow needs 16 x 76.65 = 1226.4 g unitary enterprise per day

nXP-total need (g / head per day) = 433 + 1226.4 = 1659

The need of dry cows in protein

In the last weeks before calving, the fetus develops very intensively. Therefore, the mass of the cow also increases. The need for protein is growing by 20 g nXP/50 kg increase in live weight, which corresponds to 1 g / 2,5 kg. The following formula takes into account individual deviations from standard indices:

Formula for calculating the need for assimilated protein for dry cows

nXP 6-4 weeks before calving (g / head. Per day) = (LM + 680) / 2.5 + 1135

nXP 3 weeks before calving (g / head. Per day) = (JM + 710) / 2.5 + 1230

In our example:

nXP 6-4 weeks before calving (g / head. Per day) = (600 + 680) / 2.5 + 1135 = 1647

nXP UP3 weeks before calving (g / head. Per day) = (600 + 710) / 2.5 + 1230 = 1754

Similarly, in this paper, we calculated the above standards for cows of different productivity (table 3)

Table 3 - The need for NEL and nXP for cows with a live weight of 600 kg, fat 3.6; protein 3.0

Milk production, kg	NEL, MJ	nXP, g	Milk production, kg	NEL, MJ	nXP, g
Milk cows					
14	78,2	1506	26	114,8	2425,5
16	84,3	1658,95	28	120,9	2578,75
18	90,4	1812,3	30	127	2732,5
20	96,5	1966	32	133,1	2885,35

22	102,6	2118,8	34	139,2	3038,65
24	108,7	2272,6	36	145,3	3192,4
Dry cows					
The term before calving, weeks.	NEL, MJ	nXP, g	The term before calving, weeks.	NEL, MJ	nXP, g
From 6 to 4 weeks.	48,5	1647	С 3 до calwing	53,5	1754

The compilation of rations in the farm for dairy cows takes place according to the adopted European system. The diet of a milk cow includes three parts: the main feed, the balancing feed and the productive feed.

The composition of the main feed, provides animal productivity in 14 kg of milk. The composition of the main feed includes a balancing feed in the amount of 10% for energy nutrition. The main feed is fed in the form of a monoform on the feed table [16, 18, 22].

Productive feed provides higher productivity, which, along with concentrated feed, includes high-protein concentrate for dairy cows with a high level of transit starch, “protected” protein and fat.

The rations used in the farm for cows with different productivity with the use of productive compound feed are balanced for NEL, as well as for the main nutritional indicators: dry matter, crude fiber. The content of the digested protein is slightly higher than the standard values.

Table 4 describes the main parameters of the analysis of diets for the Russian and foreign systems.

Table 4 - Parameters of the analysis of diets for the Russian and foreign systems

Milk production, kg	The number of concentrates,% of		The number of productive feed, kg / goal / day	The number of concentrates per 1 kg of milk, g	Milk produced from 1 kg of dry matter, kg	Costs of 1 kg of milk	
	EFE	dry matter				EKE	rub.
14	10	7,16	-	100,0	0,81	1,16	14,4
16	16,1	11,69	1	150,0	0,88	1,09	13,7
18	21,04	15,4	1,9	183,3	0,95	1,03	13,0
20	25,43	18,82	2,8	210,0	1,02	0,98	12,6
22	29,35	21,89	3,7	231,8	1,07	0,94	12,1
24	32,89	24,88	4,6	250,0	1,13	0,90	11,8
26	36,08	27,58	5,5	265,4	1,18	0,88	11,5
28	39,08	30,19	6,43	278,6	1,22	0,86	11,3
30	41,63	32,45	7,3	290,0	1,27	0,83	11,0
32	44,32	34,88	8,3	303,1	1,30	0,82	10,9
34	46,54	36,92	9,2	311,8	1,34	0,80	10,7
36	48,58	38,85	10,1	319,4	1,38	0,79	9,3

In the basic ration, calculated on the productivity of 14 kg of milk, concentrated feed is 10%, a cow with a milk yield of 36 kg consumes ≈ 50% of concentrate on EFE, which corresponds to 7,16 and 38,85% of dry matter.

The cow on the basic ration consumes 1400 g of concentrated feed per head per day, while the cost of concentrated feed per 1 liter of milk is 100 grams, with a productivity of a cow of 36 liters, the cost per 1 liter of milk increases to 319 g. The farm receives 1 kg of milk from 1 kg of dry substance, with an increase in productivity, the yield of milk from 1 kg of dry matter increases, which indicates a greater profitability. The cost of 1 liter of milk decreases with increasing productivity.

After the start of the cows begins dry period which is divided into 2 periods.

1 part of the dry period: from the start up to 3 weeks before calving

In the early dry dead, 93.5% of dry matter accounts for the main feed, of which 40% are coarse. The dry matter contains a small amount of energy - 4.2 MJ CEL.

Part 2 of the dry period: the last 3 weeks before calving.

In the rations of the last deadwood, the proportion of concentrates increases to 24,7% versus 6,5% in early deadwood, while the concentration of the pure energy of lactation in the dry matter increases by 11,6%.

During this period, the farm balances the diet in the direction of acidic elements to help with calcium metabolism, for this, the diet of cows includes a premix with anionic salts of «Techkorm» in the amount of 200 g per head, which positively affect the parathyroid gland, contribute to the release parathyroid hormone, as a result, calcium is absorbed from the feed, which prevents maternity paresis [10, 14, 15, 24].

When the anionic premix is added on, the value of Cationo Anionic Balance becomes negative and amounts to (-298) mEq / kg, against the diet without the use of anionic salts 180 mEq / kg.

When dry cows of anion salts were turned on, a minimum number of cows with premature edema was observed.

Cows in the control group underwent difficult labor, often had to provide obstetric assistance. There were signs of retention of the placenta (not separation of the placenta within 12 hours after calving), endometritis, uterine subinvolution, mastitis.

The insemination index was maximum in the control group and amounted to 3.24 doses versus 1.83 in the experimental group. The service period was shorter in the experimental group and averaged 122.4 days versus 145.4 in control, since cows had a more favorable course of the postpartum period.

After calving, the cows in the experimental group felt better, which was manifested by greater feed intake and higher yields.

So in the first 60 days of lactation, the average daily milk yield in the experimental group was 36 kg of milk, in the control 32 kg.

Analyzing the table, we note that from one kilogram of dry matter in the control group, more milk is obtained.

Table 5 - The economic efficiency of the use of rations for dairy cows

Index	Control	Experienced
1. Daily milk yield, kg	32	36
2. The content of the EFE in the diet	26,2	28,4
3. Feed cost per 1 kg of milk, EFE	0,8	0,8
4. Ate dry matter, kg	24,6	26,1
5. Milk produced from 1 kg of dry matter, kg	1,3	1,4
6. Cost of diet, rub.	316,3	345,25
7. Cost of 1 EFE ration, rub.	12,1	12,2
8. The cost of feed spent on 1 kg of milk, rub.	9,88	9,59
9. Cost savings of feed per 1 kg of milk, rub.		0,29

Despite the high cost of the diet of the experimental group, the cost of feed spent per 1 kg of milk decreases.

At the same time, the cost savings of feed per 1 kg of milk is 29 kopecks. From the control and experimental groups for 60 days of lactation we will receive:

From the control: 32 l * 103 heads * 60 days = 197760 kg

From experienced: 36 l * 105 heads * 60 days = 226800 kg

The difference will be 29040 kg, while we will additionally receive 29040 kg * 0.29 rubles = 8421.6 rubles.

But in the experimental group, anionic salts were fed 200 grams per day during the dry period. In this case, for the whole deadwood spent: 0.2 kg * 20 days * 105 heads = 420 kg. Net profit in this case will be: 8421.6- (420 * 11.5 rubles) = 3591.6 rubles.

CONCLUSIONS

The results of the calculation of the net energy of lactation (NEL), the assimilated protein (nXP), the nitrogen balance in the rumen (BAR, RNB) in the ensiled alfalfa mass, correspond to the data of the Eurofins BLGG AgroXpertus laboratory protocols.

The need of cows for dry matter, Pure Energy of Lactation, assimilable protein, as well as Nitrogen Balance in the Rumen for cows depends on body weight, milk yield, fat content and protein in milk.

The preparation of rations in the farm is carried out according to the adopted European system, which includes three parts of the diet: the main feed, balancing and productive feed.

In the basic ration, calculated on the productivity of 14 kg of milk, concentrated feed is 10%, a cow with a milk yield of 36 kg consumes ≈ 50% of concentrate on EFE, which corresponds to 7,16 and 38,85% of dry matter.

The cow on the basic ration consumes 1400 g of concentrated feed per head per day, while the cost of concentrated feed per 1 liter of milk is 100 grams, with a productivity of a cow of 36 liters, the cost of concentrates per 1 liter of milk increases to 319,4 g. kg of dry matter in the farm receive 1 kg of milk, with an increase in productivity, the yield of milk from 1 kg of dry matter increases, which indicates a greater profitability. The cost of 1 liter of milk decreases with increasing productivity.

Dry cows in the last three weeks before calving include premixes with anionic salts, while the milk yield for cows in the post-hospital period is 36 kg versus 32 kg in the control group without the use of anionic salts.

The net profit from the use of premix with anion salts for 60 days of lactation in the post-war period from 105 heads will be 3591,6 rubles.

REFERENCES

[1] Introductory course "Norms and diets of feeding" of 9 parts: [website] [Electronic resource]. - Access mode: https://soft-agro.com/wp-content/uploads/2013/01/1-4chast.pdf

[2] How to calculate the net energy of lactation, assimilated protein and nitrogen balance in the rumen for feed, knowing the data on raw protein, crude fat, crude fiber, crude ash and BEV: [site] [Electronic resource]. - Access mode: https://soft-agro.com/korovy/kak-rasschitat-pokazateli.html.

[3] Kalashnikov A.P. Norms and diets for feeding farm animals / A.P. Kalashnikov, V.I. Fisinin, V.V. Scheglov, N.I. Kleimenov. - M., 2003.- 456 p.

[4] Amount of feed that a cow actually eats: [website] [Electronic resource]. - Access mode: https://soft-agro.com/korovy/kolichestvo-korma-kotoroe-fakticheski-poedaet-korova.html.

[5] Feeding of animals: a textbook for university students enrolled in the areas of training "Zootechny" (bachelor degree) and "Veterinary" (specialty): [in 2 tons]. [T. 2] / Ros. state. agrarian. un-t - ICCA; under the Society. Ed. I.F. Draganova, N.G. Makartseva, V.V. Kalashnikova .- M.: RSAU Publishing House - Moscow Agricultural Academy, 2010 .- 564 p.

[6] Feeding of cows in different periods of lactation: [website] [Electronic resource]. –Https: //soft-agro.com/korovy/kormlenie-korov-v-raznye-periody-laktacii.html.
[7] Makartsev N.G. Feeding of farm animals: a textbook for university students enrolled in the areas of training "Zootechny" and "Veterinary" / N.G. Makartsev .— 3rd ed., Pererab. and additional .- Kaluga: Noosphere, 2012 .- 640 p.
[8] Master class: make up the diet for the cow. - Access mode: https://soft-agro.com/korovy/master-klass-sostavlyaem-racion-dlya-korovy.html.
[9] Is it possible to silage alfalfa? Soldatova [et al.] // Agricultural News. - №1. -2016. - 49-50 s.
[10] Prevent maternity paresis: what is effective? : [website] [Electronic resource]. - Access mode: https://soft-agro.com/korovy/predotvratit-rodilnyj-parez-chto-effektivno.html
[11] Preparation of silage and hay with the use of domestic biological products / [In. A. Bondarev [et al.]; - M .: FGBBU VNII feed them. V.R. Williams, 2016. - 212 p.
[12] Production of roughage: textbook.-practical. hands. on pr-vu roughage: in 2 books. / under total. Ed. D. Shpaar. KN. 1 .— Torzhok: Option, 2002. — 360 p.
[13] Production of roughage: textbook.-practical. hands. on pr-vu roughage: in 2 books. / under total. Ed. D. Shpaar. KN. 2 .— Torzhok: Option, 2002. — 373 p.
[14] Maternity paresis: [site] [Electronic resource]. - Access mode: http://www.activestudy.info/rodilnyj-parez.
[15] Maternity paresis: the latest research for effective prevention: [website] [Electronic resource]. - Access mode: https://soft-agro.com/korovy/rodilnyj-parez-novejshie-issledovaniya-dlya-effektivnoj-profilaktiki.html.
[16] Three parts of the milch cow ration: the main feed - balancing feed - productive feed: [website] [Electronic resource]. - Access mode: https://soft-agro.com/korovy/tri-chasti-raciona-dojnoj-korovy-osnovnoj-korm-%E2%80%93-balansiruyushhij-korm-% E2%80%93-produktivnyj- kombikorm.html.