

УДК: 636.084.52

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THE USE OF DIFFERENT FEEDING STANDARDS FOR COWS

Annotation. *The article deals with the results of study concerning to the dairy cows whose yield for previous lactation was 4-5 thousand kg (40 heads), 5-6 thousand kg (40 heads), 6-7 thousand kg (40 heads), using in feeding the standards of USA, NRC (2001), English, FIM (2004), Russian (2003) and new Ukrainian (2009).*

The experiment lasted during the lactation period when the cows received basic ration the was the same for all, and the balancing was conducted in accordance with the standards through the concentration of essential nutrients in dry substances, due to concentrated feed and premixes.

Milk yield of cows fed under Russian standards was 5243 kg with fat content of 3,75%, under Ukrainian standards – 5632 kg with fat content of 3,73%, under English standards – 5837 kg with fat content of 3,76% and under American standards – 6019 kg with fat content of 3,71%.

Key words: *feed, animal, systems, standards, feeding, cows, milk productivity.*

Statement of the problem and analysis of recent researches and publications initiating its solution.

The effectiveness of dairy cattle breeding and its profitability depends on feeding requirements of cows. Feeding requirements of cows are defined by a certain amount of energy, nutrients and bioactive substances necessary for life needs of animals, their concentration in the dry substances and the correlation between them. Organizing the feeding of ruminants one must remember that first we feed rumen microorganisms, which should be treated in optimal conditions for reproduction and thus improve the provision of the host organism (animal) by easily accessible deficient nutrients. The availability of neutral detergent and acid detergent fiber, protein solubility in the rumen and its microbial synthesis efficiency, critical amino acids and the use of short-chain and long-chain saturated and unsaturated fatty acids, the ratio of fiber and no fiber carbohydrates should be taken into account.

Organizing the feeding of the cows own approaches are developed in different countries to determine the animal nutrient needs, to set standards, rations and the full ration feeding. Today in most countries with well-developed zoo technical science one should come to understand that the term “feeding” insufficiently captures the essence of the processes occurring in animals, and therefore the term “nutrition”, which characterizes the metabolism after the animal consumed feed, and thus there is a need to learn the ways how to manage these processes.

In Germany, for assessing the structure of feed the raw fiber, content of structural fiber in it and ration quality score is used. In English-speaking environment for this assessment the concepts of neutral detergent fiber, acid detergent fiber and acid detergent lignin are used. Herewith the concepts of raw fiber and raw fiber fractions have different meanings.

In the middle of the twentieth century an assessing feeding system and the animal needs in metabolic energy (ARC, CIS) were developed, as well as systems based on the principle of clean energy (NEF, NRC, INRA). Comparison of standardized animal feeding using different systems, while having substantial differences in the characteristics of energy as well as in the assessing the energy nutrient feed, gives similar results in the production testing [3-5].

The most depth studies are conducted in the USA, led by the National Research Centre, and in particular the Committee on Livestock and relevant subcommittees, although Americans have borrowed some of the approaches in European science. The standards in USA are developed for the Holstein cattle, large by weight, and are calculated on the yield of about 10 thousand kg of milk per lactation. The situation in Europe is somewhat different; milk yield of cows is in the range of 6-7 thousand kg of milk.

New approaches to improve the assessment standard principles – Bath Feeding are offered in England, Denmark, Norway and Russia. It is proposed to shift from the feed assessment principles of raw or digestible compound groups to assess of complex substrates, which are formed in the digestive tract from the nutrients

of feed. The aim is to determine the needs of the animals in the substrate and the development of standardized animal feed commercial programs, based on new principles of standard. In this case, the objective is to improve and complement the systems, which are based on the principles of metabolize energy, supplementing them by metabolic processes transcript and actual quantitative data of substrates in energy metabolism and biosynthesis of products [1].

The English system of feeding standards for dairy cows FIM (Feed into Milk) was established on the basis of unification, specification and elements of such systems as ARC (1980, 1984), INRA (1988), AFRC (1990, 1993) NRC (2001), and researches of individual scientists in dairy cattle nutrition. It was published in 2004, edited by S. Thomas [3].

Objectives of Study – verify the effectiveness of dairy cows feeding according to the standards adopted in the USA, NRC (2001), England, FIM (2004), Russia (2003) and Ukraine (2009). The comparison of the effectiveness of the feeding standards for dairy cows in different countries in terms of one sector will enable to make an unbiased opinion about the effectiveness of the certain standards and methods to ensure complete nutrition.

Materials and general methods. The research was conducted at the Co. Ltd “Crystal 2”, Velyka Bagachka town, Poltava region on a dairy farm with 850 cows. The experiment was performed by balanced groups with cows of all lactations. Analogical principle of groups was achieved by matching pairs – unique indicators such as breed, number of lactations, physiological condition, live weight, yield for the last lactation, milk yield per egalitarian period. All cows selected for the experiment had average fatness and were clinically healthy.

Cows were kept in standard 4-row barns, tied with a daily walking between milking. The feed was handed out by mobile fodder. The cows were milked in portable buckets, three times a day. The experiment was carried out in the early February 2011 to January 2012 during the period of lactation. The following feed was used to feed cows: meadows hay, alfalfa hay + sainfoin, pea straw, corn silage supplemented with wheat and corn middlings, sour beet pulp, dry beet pulp, molasses, sunflower bagasse, soybean bagasse, mixed fodder and premix. In summer, cows received meadow grass, alfalfa grass, alfalfa hay, sainfoin and concentrated feed.

The experiment was carried out according to the scheme given in table 1.

Table 1

Scheme of Experiment

Standards	Group	Milk Yield for Lactation, thousand kg	Number of Cows	Preparation Time (30 days)	Research Time (270 days)
Ukrainian (2009)	1.1	4-5	10	The Basic Ration	The Basic Ration (voluminous and concentrated feed) + concentrate feed and premixes according to the standards
	1.2	5-6	10		
	1.3	6-7	10		
Russian (2003)	2.1	4-5	10		
	2.2	5-6	10		
	2.3	6-7	10		
English FIM (2004)	3.1	4-5	10		
	3.2	5-6	10		
	3.3	6-7	10		
USA, NRC (2001)	4.1	4-5	10		
	4.2	5-6	10		
	4.3	6-7	10		

The basic ration was the same for all, and the balancing was performed due to the concentration of essential nutrients in dry substance, so one can get comparable data. Commercial standards were used in determining the amount of feed. Concentrated feed and feed additives were added to all the animals manually. Balance experiments were carried out during the research and business activities on a similar scheme.

The milk production accounting was performed daily for each group during lactation and individually to each cow three times a month, through controlling milk yield. Milk for analysis was taken once a month. Sampling of milk and preparing it for analysis – carried out in accordance with State Standard 3662-97. The content of milk was determined monthly by fat, protein, sugar and ash. The digital material was processed on a personal computer with standard software.

Study results and its discussion. The nutrient needs, due to different standard approaches was measured through the concentration of nutrients in dry substance, thus feeding to all the animals was provided by essential nutrients according to Russian standards, as a minimum of concentration; the nutrient content for other animals was increased according to the experiment scheme through the concentration in dry substance by the concentrated feed and premixes.

Table 2

Apparent Digestibility of Nutrient Rations

Group	Organic Substance	Raw Protein	Raw Fat	Raw Fiber	Nitrogen Free Extract Substances
I	75,0±0,24	66,5±0,34	63,3±1,1	55,0±0,89	82,5±0,12
II	75,9±0,22	67,0±0,94	64,0±0,67	55,5±0,71	83,6±0,68
III	76,2±0,43	68,2±0,41	65,1±0,35	58,1±0,87	84,5±0,59
IV	77,0±0,37	69,0±0,41	66,1±0,56	59,1±0,79	85,1±0,54

Digestibility of nutrients by cows in the research groups II-IV was higher compared to the first, in the III-IV groups this advantage was significant (tabl. 2).

Table 3

4% Milk Yield for 10 Months of Lactation, M±m

Group	Standards	4% milk yield			
		Period of Lactation			By Lactation
		Beginning	Middle	End	
I	Russian (2003)	19,84±0,86	16,92±0,84	12,22±0,73	16,24±0,66
II	Ukrainian (2009)	22,17±1,00	17,65±0,86	13,11±0,83	17,38±0,76
III	English (FIM, 2004)	22,38±1,10	19,03±1,07	13,83±0,98	18,15±0,86
IV	USA, NRC (2001)	22,19±1,05	19,70±1,08*	14,42±1,02	18,46±0,89*

Assessing the average daily milk yield of cows fed according to Ukrainian standards (2009) it should be noted that only cows with milk yield of 4-5 and 5-6 thousand kg of milk had higher indicators than in Russian standards, for yield 6-7 thousand kg the difference was 1,9 kg, but not significant (table 3).

Characterizing the average daily milk yield of 4% fat during lactation it is necessary to emphasize that they are somewhat less than the natural milk yields as the average fat of milk was less than 4% using the Russian standards – 3,75%, Ukrainian – 3,73%, English – 3,76% and American – 3,71% on average (table 4).

The lowest average daily yield of 4% milk was set when using Russian standards; it was 16,24 kg, with fluctuations in cows of different productivity from 13,39 kg to 19,04 kg. Under Ukrainian standards the higher yield in early lactation was seen, but because of the significant errors in arithmetic average the difference of milk yield was 6.9% statistically unreliable. Fluctuations in average daily milk yield in animals with different productivity ranged from 14,44 to 19,60 kg. Using English standards the average daily yield of 4% milk during the experiment with 30 cows was 18,15 kg of milk that is compared with Russian standards 11,8% more with a range from 15,18 to 20,67kg.

The most effective were American standards, which provided average daily yield of 4% milk – 18.46 kg (15,35-21,57), as compared with Russian standards – 13,7% more.

Assessing the reliability of indicators, we can conclude that the use of American standards provides significantly higher productivity in the middle of lactation and generally during all lactation, whereas the English standards provide a significant increase only at 5-6 kg milk yield per lactation.

Thus, Ukrainian standards provide milk productivity on the level to 6 thousand kg of milk significantly higher than the Russian standards, with 6-7 thousand kg of milk per lactation the difference is not significant.

High average daily milk yield obtained from animals treated with ration in accordance with the standards of NRC (2001), where cows per lactation received 6019 kg of milk at an average daily milk yield of 20,1 kg ($P < 0,95$) (table 4).

Table 4

Productivity of Cows During Lactation, M ± m

Group	Average Yield, kg (n = 300)	Fat Content in Milk, %	Gross Yield, kg (n = 30)
1	17,5±0,34	3,75±0,14	5242,8±103,0
2	18,8±0,49*	3,73±0,14	5632,2±145,7*
3	19,5±0,45*	3,76±0,14	5837,4±136,0*
4	20,1±0,52*	3,71±0,14	6019,0±168,2*

Moreover, the productivity of animals with yield of 4-5 thousand kg of milk per day was 16,3 kg (4904 kg per lactation), 5-6 thousand kg – 19,8 (5953 kg per lactation), 6-7 thousand kg milk – 24,0 kg (7200 kg per lactation). All of these indicators for each group were significantly higher comparing with Russian standards. In particular, the average daily milk yield in the group of animals with the yield of 4,5 thousand kg of milk were 14,8% higher, with yield of 5,6 thousand kg of milk – 12,5% higher, with a yield of 6-7 thousand kg of milk – 16,5% higher and according to NRC (2001) standards – 14,9% higher on average. Those groups with higher milk yield of cows have digested better organic substance and protein, had more metabolize energy, used it better on milk production. In this case, the energy loss in the faeces of cows was lower. It should be noted that the nitrogen assimilation in animals fed under English and American standards was the highest that provides more excretion of it with in milk.

The study of biochemical indexes of blood: total protein, alkaline reserve, calcium, phosphorus, carotene found no significant differences between the groups and all the indicators were within the physiological standards.

Conclusions and Perspectives for Study. Evaluating natural milk yield it should be noted that for 300 days of study the first group of cows gave 5242,8 kg milk, that is 7,4% more from the second group, 11,4 % more from the third group and 14,8% more from the fourth group. In terms of 4% milk tendency remains the same, but the difference is not statistically significant because of the big error. It is advisable to continue the study of the effectiveness of using different standards for different feeding types and systems of keeping cows.

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Анотація. Наведені результати досліджень на дійних коровах, молочна продуктивність яких за попередню лактацію була 4-5 тис. кг (40 голів), 5-6 тис. кг (40 голів), 6-7 тис. кг (40 голів, за використання при організації годівлі норм США, NRC (2001), англійських, FIM (2004), російських (2003) і нових українських (2009). Дослід тривав протягом лактації, під час якої корови одержували основний раціон, однаковий для всіх, а балансування здійснювали відповідно до норм через концентрацію необхідних поживних речовин в сухій речовині, за рахунок концентрованих кормів та преміксів. Молочна продуктивність корів, яких годували за російськими нормами була 5243 кг жирністю 3,75%, українських – 5632 кг і 3,73%, англійських норм – 5837 кг і 3,76% і американських норм – 6019 кг і 3,71% відповідно.

Ключові слова: корми, тварини, системи, норми, годівля, корови, молочна продуктивність.

Аннотация. Приведены результаты исследований на дойных коровах, молочная продуктивность которых была 4-5 тыс. кг (40 голов), 5-6 тыс. кг (40 голов), 6-7 тыс. кг (40 голов) при использовании в организации кормления норм США, NRC (2001), английских, FIM (2004), российских (2003) и новых украинских (2009). Опыт длился в течение лактации, во время которого коровы получали основной рацион, одинаковый для всех, а балансирование осуществляли в соответствии с нормами через концентрацию необходимых питательных веществ в сухом веществе за счет концентрированных кормов и премиксов. Молочная продуктивность коров, которых кормили по российским нормам, была 5243 кг жирностью 3,75%, украинским - 5632 кг и 3,73%, английским нормам – 5837 кг и 3,76% и американским нормам – 6019 кг и 3,71% соответственно.

Ключевые слова: корма, животные, системы, нормы, кормление, коровы, молочная продуктивность.