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PROTEAN NUTRITION OPTIMIZATION FOR COWS WITH HIGH MILK PRODUCTION BY USING AN UNPROTEIC NATRIUM SOURCE ASSOCIATED WITH ENERGY AND MINERAL SUPPLEMENTS

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Abstract

To ensure the necessary amount of protein for dairy cows with high milk production represents for farmers a permanent challenge directed both to supply and store raw protean materials, as well as to search for the means to exploit the ruminant digestive peculiarities in terms of producing microbial endogenous protein with high biological value of non-protean nitrogen sources in terms of energy and mineral optimization. Starting from these considerations, we have achieved a formula optimization during the "stable" period, meant for this category of animals by means of total or partial substitution of the main raw protein material in compound feed structure (soya meal) with an alternative source of nitrogen (urea) in four experimental variants of formula. For this operation, we approached the three basic levels necessary for the replacement of an organic protean source with an inorganic one, such as: adjusting the speed of decomposition at ruminating level, speed and length of nitrogen release ; to ensure a suitable level of energy support, speed and duration of release of nitrogen; creating a suitable spectrum for some mineral elements involved in microbial protein synthesis. In these circumstances, we managed the formulation of some compound feed in where the share of total provided non-protein nitrogen varied between 18.3 and 29.6%.

Key words: *mineral supplement, mollasses, protein, soya meal, urea, vegetal fats.*

INTRODUCTION

The permanent concern of specialists in the field of bulls breeding to get ever higher milk production (35 l/cow/day) requires a faster resolution to the issues related to identifying and securing protein sources which have to support at an adequate level the quantity and quality of the product, at the same time keeping the animals in a proper state of maintenance. Taking into account the ruminants digestive peculiarities and also of the difficulty in purchasing classical protean raw materials (mainly meals) livestock nutritionists recommend the use of alternative protein sources to substitute a larger percentage of the total protein in the formula (Kleen, 2010).

An industrial product which can be used for this purpose is the urea $CO(NH_2)_2$, whose high nitrogen content (42-46%) provides this uneffective element presence in the rumen, but with a major role in micro-organisms growth and multiplication, which in turn represents both an important link in the process of formula digestion, as well as a valuable source of protein (450-650 g/day), volorized at the level of the other segments of the digestive tract (Dragomir and al., 2010).

High nitrogen content of urea and its release in the rumen is done quickly, (nitrogen split is about 4 times more intense than the use of microbial protein synthesis) (Hutiens, 2010), it requires finding processes by means of which the urea decomposition to be done gradually, so that the risk of accidents caused by excess ammonia to be removed (Chase and al., 2007). But on the other hand, protein is the most complex organic substance, so that nitrogen provision is not the only missing link in the complex process of microbial multiplication, whole series of mineral elements being also necessary (in particular, sulphur, phosphorus, cobalt, zinc, manganese) which form the amino acids structure (Stoica and al., 2010). To this, it is added the fact that any process of synthesis also requires a power source corresponding to the intensity and length of the respective activity. All this process (of microbial

synthesis) should be unfolded in ruminal pH optimum limits to maintain favorable fermentative processes for the production of volatile fatty acids involved in milk synthesis (Velea and Marginean, 2012).
This simultaneous coordination necessary for the optimum unfoldement of physiological processes comes to livestock nutritionists who have to provide to the breeder an energy-protein-mineral 'package' easy to use and to exploit the maximum potential of the protean endogenous synthesis of animals (Beever and Doyle, 2007).

MATERIALS AND METHODS

In the context of the elements outlined above and taking into account the recommendations concerning the non-nitrogen doses that can be used for maintenance and health of the animals status, the conditions to be observed in case of using an inorganic sources of nitrogen, we have made two steps of optimizing the report protean nitrogen - non-protean nitrogen. This was carried out through partial or total replacement, in the structure of the combined feeds, of soya meal with a non-nitrogen source (urea) in two combinations with a variety of substances (mineral and energetic ones) which have an increasing role of ruminal microorganisms activity.
The two combinations where urea is found differ among themselves by the way of fixing it, such as:
- in Rumagen product, urea is fixed on a support of gelly starch, which gives a delay of ammonia release at a ruminal level, and for the energetic support there were also incorporated oils (sunflower and rapeseed). The structure of this product can be synthesized as follows: crude protein, crude protein equivalent of nitrogen 85.5%, oils 5%, crude fiber 2%;
- a mixture of urea + an easy fermentable glucid (molasses) which involves the inclusion of urea in the compound feeds production flow and the spray of energy supplement on the fodder grains.
To adjust the intake of essential minerals in the microbial synthesis process of microbial capable, there was conceived a formula of premix where macro and micro-elements have been supplemented, depending on their degree of involvement in this complex physiological process.
Optimization activity of formula for lactation cows was achieved through the use of the main pillars that control the formula, namely:
1. Energy necessary calculus and protein for maintenance and production (taking into account the average values of animals weight and milk production), the calculus relations being the following:
- for energy (milk nutritive units MNL)
a. maintenance MNL = 1.8 + 0.006 x GV
b. production MNL = 0.47 x PL
where : GV = live weight (kg);
PL = milk production (l/day).
- for protein
a. PDI (g) maintenance = 3.25 g x $G^{0,75}$ (kg)
b. PDI (g) production = 50 g x PL (l/day)
where: $G^{0,75}$ = metabolic weight
2. Identify sources and obtain the necessary fodders for the production of formulae, the determination of chemical composition and their nutritive value, using the calculus basis for UNL and PDI
3. Ccompliance with the basic principles for the formulae elaboration in lactating cows, namely ensuring adequate physical structure conditions, optimal loading and fermentability coefficient.
4. Using an alternative source of nitrogen (urea) for the total or partial replacement of soya meal, at the same time with the ensurance of a mineral and energy support corresponding to the nitrogen contribution.

RESULTS AND DISCUSSIONS

1. The obtained results for the calculus of the energy and nutritive substances.
Adjusting the calculus relations of the energy and protean necessary to the production characteristics (361/day) and animals weight (600 kg), there were obtained the following values:
- for energy (milk nutritive units UNL)
a. UNL maintenance 1.8 + 0.006 x 600 (kg) = 5,4
b. UNL production = 0.47 x 36 (l/day) = 17
Total = 22.4 UNL.
- for protein
a. PDI (g) maintenance 3.25 g x 121.23 (kg) = 394

b. PDI (g) production = 50 g x 36 (l/zi) = 1800
Total = 2194 g PDI

2. Results obtained in the identification and the determination of the fodder nutritional value necessary to formulae elaboration.

The main feed to be used in the formulae elaboration for the winter period and their nutritive value expressed in MNL, PDI, crude protein and metabolisable energy are presented in tables 1 and 2.

Note that for these feeds (except beer residues) there were achieved stocks necessary to feed 35 animals (5 livestock x 7 cows/livestock) over a period of 180 days, respectively from December 2012 – April 2013.

For the beer residues, there is a strict contract of supply which is unfolded without difficulty all over the year.

Rumagen product is designed and delivered by Alltech Romania and the corresponding quantities of urea and molasses were purchased and stored in the warehouse IBNA-Balotesti which ensures also the production of compound feeds.

3. Results obtained in the field of formulae elaboration.

Formulae intended for cows in lactation were comprised so that as to comply with the conditions mentioned above, they can be characterized as a tile which has 2 distinct branches, namely:

a. basic formula made only of volume fodders (Table 3) which should ensure the necessay for the maintenance and achievement of 10 l milk production;

b. complementary formula, represented by compound feed (tables 4 and 5). Regarding the compound feed, please note that the experimental variants are presented in comparison with the control group only at the level of crude protein-metabolisable energy and, without holding onto account of the MNL and PDI, as this mode of expression to be achieved after testing the product.

Using the structures foreseen in the experimental variants, we notice that the highest amounts of urea is registered with the experimental version no.4 (18 g urea/kg /combined feed), which is the corresponding amount of urea/day, 198, g a dose 33 g100 kg AW being followed by the experimental version no. 3 with 16 g of urea/kg of combined fodder, 176 g urea/day of combined fodder,. the dosage being of 29 g urea /100 kg AW ,the other two variants being limited to 22 g urea /100 AW for the experimental version no. 2, respectively 20 g urea/ 100 kgAW for the experimental version no.1.

Table 1. Fodders used for formulae elaboration meant to lactating cows

Fodder	SU (g/kg)	UNL	PDIN (g/kg)	PDIE (g/kg)	Ca (g/kg)	P (g/kg)
Alfa-alfa hay	880	0,60	75	65	10	1,9
Sudan grass hay	850	0,66	43	62	7	1,2
Pickled corn, early milk stage	260	0,22	13	17	1,2	0,5
Beer residues	225	0,19	30	18	1	0,6
Corn	880	1,27	73	110	0,3	2,3
Wheat	870	1,20	79	101	0,7	3,5
Wheat bran	880	0,84	101	82	1,9	10
Soya meal	900	1,14	317	229	2,2	7
Rapeseed meal	890	0,99	227	131	5,5	9

Table 2. Raw materials used in formulae elaboration –PB expression (g/kg) si EM (kcal/kg)

Specifi-cation	Corn	Wheat	Wheat Bran	Soya meal	Rapessed meal	Mollasses	Urea	Rumagen	Alfa-alfa hay	Sudan grass hay	Pickled corn	Beer residues
PB	82	120	140	450	320	90	2600	1120	106	74	23	50
EM	3360	3190	2840	3130	3100	2925	-	3060	2413	2230	695	520

Table 3. Formula structure meant for lactating cows

Fodder/ Norm	kg	DM (kg)	UNL Total=22.4 Maintenance+10 l=10.1	PDIN (g) Total=2194 Maintenance +10 l=894	PDIE (g) Total=2194 Maintenance+10 l=894	Ca (g) 140	P (g) 100
Alfa-alfa hay	3	2.64	1.80	225	195	30	5.7
Sudan grass hay	3	2.55	1.98	129	186	21	3.6
Pickled corn	21	5.46	4.62	273	357	25.2	10.5
Beer residues	9	2.02	1.71	270	162	9	5.4
Basic formula total		12.67	10.11	897	900	85.2	25.2
Loss		-	12.3	1297	1294	54.8	74.8
Compound meal	11	9.68	12.32	1298	1298	76	76
TOTAL		22.35	22.43	2195	2198	161.2	101.1

Table 4. Structure of compound feed formulated for lactation cows during experimental period

Specification/ Fodders	VM			VE1			VE2			VE3			VE4		
	Quantity (kg)	PB (g /kg)	EM (kcal /kg)	Can-titate (kg)	PB (g /kg)	EM (kcal /kg)	Can-titate (kg)	PB (g /kg)	EM (kcal /kg)	Can-titate (kg)	PB (g /kg)	EM (kcal /kg)	Can-titate (kg)	PB (g /kg)	EM (kcal /kg)
Corn	47	39	1579	47	39	1579	47	39	1579	47	39	1579	47	39	1579
Wheat	15	18	480	20,8	25	663	17	20	542	23.4	28	746	20.9	25	668
Wheat bran	15	21	426	15	21	426	15	21	426	15	21	426	15	21	426
Rapeseed meal	7	22	217	7	22	217	7	22	217	7	22	217	7	22	217
Soya meal	13	58	406	4	18	126	5	22	157	-	-	-	-	-	-
Rumagen	-	-	-	3	33	92	-	-	-	4.3	48	132	-	-	-
Urea	-	-	-	-	-	-	1.2	31	-	-	-	-	1.8	47	-
Mollasses	-	-	-	-	-	-	3.6	3	105	-	-	-	5	4	145
Premix VL I	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Premix VL II	-	-	-	3,2	-	-	3.2	-	-	3.3	-	-	3.3	-	-
Total	100	158	3108	100	158	3103	100	158	3026	100	158	3100	100	158	3035

Table 5. Compound meal structure - control variant , expressed in UNL and PDI system

Fodder	kg	SU (kg)	UNL	PDIN (g)	PDIE (g)	Ca (g)	P (g)
Corn	47	41.36	59.69	3431	5170	14.1	108.1
Wheat	15	13.05	18.00	1185	1515	10.5	52.5
Soya meal	13	11.70	14.82	4121	2977	28.6	91.0
Rapeseed meal	7	6.23	6.93	1589	917	38.5	63.0
Wheat bran	15	13.20	12.6	1515	1230	28.5	150.0
Premix VL I	3	2.26	-	-	-	570	230.0
Total	100	87.80	112.04	11841	11809	690.2	694.6
	1	0.88	1.12	118	118	6.9	6.9

Analyzing energy and protein parameters of compound meal, we acknowledge a great uniformity at the level of metabolic energy whose values are placed around 3100 kcal, the maximum difference being of 82 kcal (2.6%) recorded between the control and experimental variant version 2, this one being considered negligible, particularly at the level of the protein, where the value of 158 g/kg meets at all experimental variants.

In these conditions, energy-protein ratio has almost imperceptible limits, variations comprised between 19.2 and 19.6 kcal E. M/g crude protein.

CONCLUSIONS

1. Formula optimization for cows is the main condition in order to obtain some milk productions quantitative and qualitative superior.

2. Among all nutritional parameters which must be ensured in order to support a high milk production, under animal optimal physiological conditions, most of the times, protein represents the limiting factor for formula.

3. The ruminant physiological peculiarities make possible to use alternative sources of

protein to serve as 'donors' of nitrogen for the development of microbial populations in the rumen.

4. When to use inorganic sources of nitrogen in dairy cows formula, we must find solutions both for ammonia release distribution and for the energy and mineral support of microbial biosynthesis.

5. By means of professional coordination of all factors involved in achieving physiological balance in the rumen, the non-protean nitrogen can provide about 20 %of the total protein in the formula, which allows obtaining some formula of combined fodder where soy meal can be totally substituted by urea.

6. The use of urea in compound feeds structure combined fed to high-dairy cattle milk production involves a lot of attention from nutritionists in terms of identification and use inside the formula of fodder ingredients (fibrous and succulent) that should allow the ensuring of physical structure conditions, fermentability and charging coefficient adequate to this animal category.

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