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OPTIMIZATION OF FEED COMPOSITION FOR TURKEYS

Abstract

The article describes that domestic feed products cannot always compete with high quality products of foreign firms. However, the use of imported feed leads to a significant increase in their value and, as a consequence, to an increase in the cost price of the final product.

It is established that for the normal development and realization of productivity, turkeys should receive quality and balanced for all indicators of compound feed. Therefore, the task was to develop recipes for turkeys using high quality domestic raw materials.

The necessity to determine the complete components characteristics of compound feeds for the finished products production, which meets the requirements of regulatory documents and the consumer, has been proved. There are many indicators and factors that are not taken into account when calculating recipes, but significantly affect the compound feed quality.

We have developed compound feed recipes for heavy type turkeys aged 1...4 weeks, 5...13 weeks, 14...17 weeks, 18...30 weeks and over 31 weeks using the "Korm Optima Expert" software complex. The program incorporates the principle of calculating recipes at minimum cost, taking into account the restrictions on the input of each component and the nutrition of the finished product using linear programming by formulas.

The expediency of replacing soybean meal in poultry feed due to its high cost for cheaper protein components is substantiated. In order to reduce the cost of compound feed, we have proposed the optimal composition of protein feed additive (PFA) for replacement soybean meal in feed recipes.

On the basis of the developed recipes of compound feeds for heavy type turkeys we calculated similar recipes of compound feeds with replacement of soybean meal for PFA in their composition according to the norms of its introduction

The quality indicators of finished products are in compliance with the minimum nutritional requirements of compound feeds for heavy type turkeys of a given age. The cost of compound feeds with PFA is much lower than similar with soybean meal. We determined the annual feed consumption of turkeys by growing periods based on the daily feed intake and the duration of each fattening period.

Key words: turkeys, compound feed recipes, optimization, protein feed additive, soybean meal, nutritional indicators.

Introduction

Today the feed market is filled with high quality products of foreign firms, besides sufficiently well-known and experienced. So it is very difficult for a domestic producer to overcome the stereotype of attitude towards domestic products as a low quality, which does not always meet the feeding standards of birds. The world's leading producers of mixed poultry feed are the Netherlands, Belgium, USA. The use of imported feed leads to a significant increase in their value and, as a consequence, to an increase in the cost price of the final product.

A high level of productivity and the associated level of feed conversion in the turkey meat production can only be achieved through the high-quality maintenance and use of high-quality, well-balanced and high protein diets, which include easily digestible and properly prepared feed components [1, 2].

Therefore, the urgent task is to develop recipes of high quality feeds for turkeys using available domestic raw materials.

The balance of feed for all major nutrient and biologically active substances, their good quality is determined mainly by the quality of their constituent components. It is necessary to know the full description of the feed components in order to ensure the feed production that meets the requirements of regulatory documents and consumers.

When forming the composition of the recipe, the information about the nutritional value and chemical composition of raw materials, which include the content of exchange energy, protein, amino acids, fat, fiber, and minerals, is used as initial data.

However, each of the feed component is characterized by a wider range of indicators and factors that are usually not taken into account in the calculations, but have a significant impact on the quality of the prepared feed [3, 4, 5].

Purpose and objectives of the analysis

The purpose of the study is reducing the cost of feed for turkeys by optimizing the recipes for heavy type turkeys mixed feeds. It is proposed to replace the expensive soybean meal in the recipe with a protein feed additive to achieve this goal.

Results and its discussion

The following components were selected for the development of compound feed recipes for the heavy type turkeys: corn, shelled oats, shelled barley, triticale, soyabean full-fat, sorghum, wheat bran, wheat fodder flour, soybean meal, sunflower cake, lucerne herbal flour, meat flour, bone meal, fish meal, meat-bone meal, blood meal, sunflower oil, salt, mono-calcium phosphate, limestone flour, baking soda, fodder chalk, anhydrous sodium sulfate, DL-methionine,

Table 1 – The nutritional value and cost of the feed components for heavy type turkeys [6]

Component	Metabolizable energy, kcal/100g	Mass fraction, %											The cost, UAH/t (September 2018)	
		moisture	crude protein	crude fat	c18:2 ω6	crude fiber	Ca	P	Na	lysine	methionine	threonine		tryptophan
Maize	330	13,0	8,5	4,00	1,80	2,0	0,02	0,25	0,03	0,26	0,18	0,30	0,07	5,40
Shelled oats	287	12,0	12,2	4,70	1,63	2,2	0,10	0,30	0,03	0,50	0,20	0,40	0,17	6,50
Shelled barley	281	13,0	12,2	2,50	1,04	2,2	0,06	0,33	0,05	0,42	0,19	0,39	0,15	7,40
Triticale	285	13,0	12,1	1,50	0,60	2,5	0,06	0,40	0,03	0,38	0,20	0,36	0,12	4,00
Sorghum tannin < 0,5	295	13,0	9,5	3,10	1,08	3,0	0,05	0,28	0,03	0,22	0,17	0,32	0,12	5,10
Soybean full-fat, CP 37 %	350	12,0	37,0	18,50	9,32	5,5	0,22	0,65	0,03	2,28	0,50	1,42	0,50	16,00
Wheat bran	172	13,0	14,4	4,14	1,91	9,62	0,14	1,08	0,04	0,57	0,21	0,46	0,22	3,60
Wheat fodder flour	257	12,0	14,2	3,00	0,93	4,0	0,07	0,30	0,04	0,48	0,21	0,49	0,18	3,50
Soybean meal, CP 40 %	230	9,0	40,0	1,20	0,48	10,6	0,37	0,65	0,05	2,42	0,53	1,58	0,55	13,50
Sunflower cake, CP 32 %	223	8,0	32,0	11,50	5,46	23,0	0,35	1,10	0,09	1,10	0,72	1,17	0,42	5,50
Lucerne herbal flour, CP 17 %	120	10,0	17,0	1,00	0,10	22,0	0,90	0,26	0,07	0,74	0,26	0,67	0,24	3,50
Meat flour, CP 56 %	255	8,0	56,0	12,00	0,90	0	5,30	2,52	1,42	2,87	0,80	2,11	0,45	8,50
Bone meal, CP 35%	146	10,0	35,0	7,20	0,06	0	13,15	7,59	1,94	0,24	0,04	0,06	0,02	5,20
Fish meal, CP 67 %	303	8,0	67,0	7,40	0,10	0	4,26	2,58	1,00	4,82	1,78	2,64	0,70	23,00
Meat-bone meal, CP 44 %	210	9,0	44,0	12,50	0,52	0	7,35	3,75	1,55	1,91	0,51	1,28	0,24	7,50
Blood meal, CP 80 %	280	10,0	80,0	1,00	0,10	0	0,30	0,32	0,33	6,87	0,89	3,38	1,30	19,00
Sunflower oil	853	0,2	0	99,80	62,9	0	0	0	0	0	0	0	0	15,00
Salt	0	3,0	0	0	0	0	0,50	0	37,2	0	0	0	0	1,20
Monocalcium phosphate	0	4,0	0	0	0	0	18,0	23,0	0	0	0	0	0	18,00
Limestone flour	0	1,0	0	0	0	0	36,0	0,10	0	0	0	0	0	0,45
Fodder chalk	0	2,0	0	0	0	0	33,0	0,18	0,30	0	0	0	0	1,10
Baking soda	0	1,0	0	0	0	0	0	0	27,0	0	0	0	0	9,80
Anhydrous sodium sulfate	0	3,0	0	0	0	0	32,0	0	0	0	0	0	0	7,15
Lysine monochlorhydrate 98 %	399	1,5	94,4	0	0	0	0	0	0	78,80	0	0	0	90,00
DL-methionine 98,5 %	502	0,2	58,1	0	0	0	0	0	0	0	98,5	0	0	110,00
L-threonine 98 %	349	0,5	70,0	0	0	0	0	0	0	0	0	98,0	0	85,00
Ronozym Highfos GT turkeys	75041	5,0	2550,0	0	0	0	1775	0	150	108,50	41,1	64,7	18,3	50,00
Natufos E 10000 turkeys	90100	5,0	3825,0	0	0	0	1950	1700	26,0	204,00	17,0	221	51,0	40,00
Premix for young turkey 1-17 weeks, 1 %	0	5,0	0	0	0	0	0	0	0	0	0	0	0	50,00
Premix for young turkey 18-30 weeks, 1 %	0	5,0	0	0	0	0	0	0	0	0	0	0	0	40,00
Premix for turkey, 1 %	0	5,0	0	0	0	0	0	0	0	0	0	0	0	35,00





Table 2 – Nutritional value and cost of mixed feeds for heavy type turkeys with soybean meal and PFA

Components and nutrients	Age of turkeys, weeks									
	1-4		5-13		14-17		18-30		31 and older	
Maize	16,60	16,60	37,30	37,30	42,60	42,60	18,00	18,00	22,40	22,40
Shelled oats	6,60	6,60	-	-	-	-	-	-	-	-
Shelled barley	-	-	-	-	-	-	30,00	30,00	21,40	21,40
Triticale	5,00	5,00	10,00	10,00	10,00	10,00	10,00	10,00	14,10	14,10
Sorghum tannin < 0,5	10,00	10,00	-	-	-	-	6,30	6,30	-	-
Soybean full-fat, CP 37 %	-	-	-	-	-	-	-	-	4,00	4,00
Wheat bran	-	-	-	-	-	-	7,00	7,00	-	-
Wheat fodder flour	10,00	10,00	10,00	10,00	10,00	10,00	6,00	6,00	2,40	2,40
Soybean meal, CP 40 %	22,00	13,30	7,80	-	4,20	-	8,00	-	8,20	-
PFA	-	8,70	-	7,80	-	4,20	-	8,00	-	9,10
Sunflower cake, CP 32 %	-	-	10,00	10,00	10,00	10,00	4,00	4,00	15,00	14,00
Lucerne herbal flour, CP 17 %	-	-	-	-	-	-	2,00	2,00	-	-
Meat flour, CP 56 %	6,00	6,00	6,00	6,00	5,95	5,95	-	-	-	-
Bone meal, CP 35%	2,48	2,48	0,64	0,64	0,38	0,38	-	-	-	-
Fish meal, CP 67 %	9,97	9,97	6,00	6,00	6,00	6,00	-	-	-	-
Meat-bone meal, CP 44 %	3,00	3,00	4,00	4,00	4,00	4,00	-	-	-	-
Blood meal, CP 80 %	2,10	2,10	0,50	0,50	-	-	-	-	-	-
Sunflower oil	4,00	4,00	4,30	4,30	3,50	3,50	2,10	2,10	3,00	3,00
Salt	0,23	0,23	0,18	0,18	0,15	0,15	0,30	0,30	0,30	0,30
Monocalcium phosphate	-	-	-	-	-	-	0,54	0,54	1,12	1,12
Limestone flour	0,85	0,85	2,00	2,00	2,00	2,00	2,00	2,00	4,00	4,10
Fodder chalk	-	-	-	-	-	-	2,00	2,00	2,60	2,60
Baking soda	-	-	-	-	-	-	0,10	0,10	0,10	0,10
Anhydrous sodium sulfate	-	-	-	-	-	-	0,31	0,31	0,30	0,30
Lysine monochlorhydrate 98 %	-	-	0,17	0,17	0,17	0,17	0,23	0,23	0,04	0,04
DL-methionine 98,5 %	0,17	0,17	0,09	0,09	0,05	0,05	0,10	0,10	0,03	0,03
L-threonine 98 %	-	-	0,02	0,02	-	-	-	-	-	-
Ronozym Highfos GT turkeys	-	-	-	-	-	-	0,01	0,01	0,01	0,01
Natufos E 10000 turkeys	-	-	-	-	-	-	0,01	0,01	-	-
Premix for young turkey 1-17 weeks, 1 %	1,00	1,00	1,00	1,00	1,00	1,00	-	-	-	-
Premix for young turkey 18-30 weeks, 1 %	-	-	-	-	-	-	1,00	1,00	-	-
Premix for turkey, 1 %	-	-	-	-	-	-	-	-	1,00	1,00
Total	100	100	100	100	100	100	100	100	100	100
The cost of feed, UAH/t	13018	12681	10459	10156	9855	9692	9041	8731	9309	9039
Metabolizable energy, kcal/100 g	290	290	300	300	300	300	284	284	280	280
Crude protein, %	28,00	28,00	22,11	22,11	20,57	20,57	14,59	14,59	16,43	16,47
c18:2 ω6	3,36	3,44	4,21	4,28	3,78	3,82	2,53	2,61	3,85	3,89
Crude fiber, %	3,63	3,85	4,52	4,72	4,25	4,35	4,58	4,78	5,91	6,00
Lysine,%	1,57	1,57	1,19	1,19	1,07	1,07	0,75	0,75	0,70	0,71
Methionine,%	0,64	0,66	0,49	0,51	0,43	0,44	0,32	0,34	0,32	0,33
Methionine + cystine,%	1,00	1,02	0,79	0,81	0,72	0,73	0,58	0,60	0,60	0,62
Threonine, %	1,03	1,03	0,80	0,80	0,72	0,72	0,50	0,50	0,58	0,58
Tryptophan,%	0,31	0,31	0,22	0,22	0,20	0,20	0,17	0,17	0,20	0,20
Arginine,%	1,79	1,79	1,39	1,39	1,27	1,28	0,83	0,83	1,05	1,06
Isoleucine,%	1,03	1,03	0,80	0,80	0,74	0,74	0,54	0,54	0,64	0,64
Leucine,%	2,12	2,12	1,64	1,64	1,53	1,53	1,08	1,08	1,20	1,21
Valine,%	1,34	1,34	1,03	1,03	0,95	0,95	0,68	0,68	0,77	0,77
Histidine,%	0,69	0,69	0,51	0,51	0,47	0,47	0,34	0,34	0,40	0,40
Phenylalanine,%	1,23	1,23	0,93	0,93	0,85	0,86	0,68	0,68	0,78	0,79
Phenylalanine + tyrosine,%	2,07	2,07	1,56	1,56	1,44	1,44	1,08	1,08	1,27	1,28
Glycine,%	1,91	1,91	1,59	1,59	1,51	1,51	0,60	0,60	0,74	0,74
Calcium,%	1,71	1,73	1,76	1,77	1,71	1,72	1,96	1,97	2,80	2,85
Phosphorus,%	1,00	1,04	0,83	0,87	0,80	0,82	0,70	0,73	0,70	0,74
Phosphorus available,%	0,78	0,79	0,59	0,60	0,57	0,57	0,53	0,54	0,53	0,55
Sodium,%	0,40	0,40	0,32	0,32	0,30	0,30	0,30	0,30	0,30	0,30

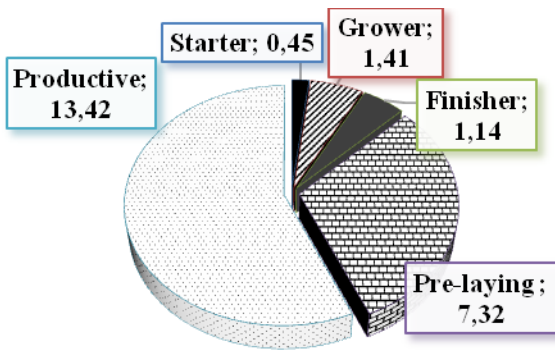


Fig. 1 - The annual feed consumption of turkeys by growing periods, kg/head

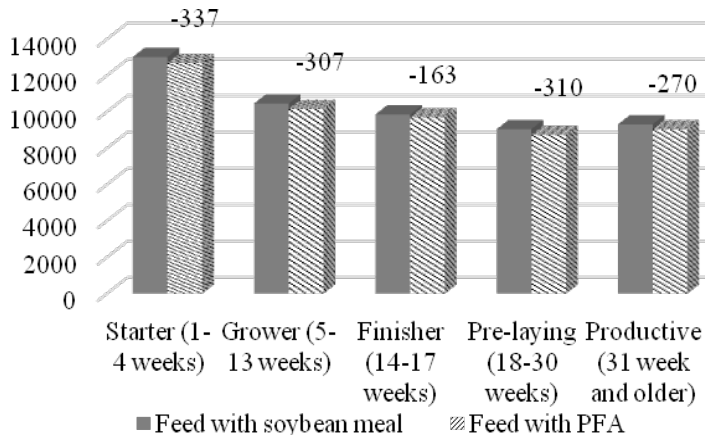


Fig. 2 - The cost of compound feeds for heavy type turkeys with soybean meal or PFA

L-threonine, lysine monochlorhydrate, premix, ronozym, natufos.

The nutritional value and cost of the feed components are given in table 1.

We have developed compound feed recipes for heavy type turkeys aged 1...4 weeks, 5...13 weeks, 14...17 weeks, 18...30 weeks and over 31 weeks using the "Korm Optima Expert" software complex [6]. The program incorporates the principle of calculating recipes at minimum cost, taking into account the restrictions on the input of each component and the nutrition of the finished product using linear programming by formulas.

We developed recipes of compound feeds for heavy type turkeys at all stages of growth and productivity with minimal cost with the help of the software complex "KormOptimaExpert". The recipes meet the standards of feeding and restrictions on the introduction of components and can be used for their full feeding (table 2).

Considering the composition of compound feed recipes for turkeys, it can be seen that soybean meal and animal feed were introduced into the mixed feeds for young animals to increase protein levels.

The price of soybean meal was 13500 - 13800UAH/t in the feed market of Ukraine according to

2018 data, that significantly increases the cost of compound feed. In addition, in Ukraine, as in the world, there is a large deficit of feed protein. Therefore, it is possible to replace soybean meal with cheaper protein components in compound feed recipes to reduce the cost of feeding farm animals and poultry and eliminate feed protein deficiency. We have developed the optimal composition and production technology for protein feed additive (PFA) to replace soybean meal in compound feed recipes. The PFA includes: sunflower meal, fodder yeast, wheat fodder flour, wheat bran, sunflower oil, lysine monochlorhydrate, L-threonine, L-tryptophan, limestone flour. The cost of PFA is much lower than soybean meal, and nutritional indicators are in compliance with the specified quality [7].

On the basis of the developed recipes of compound feeds for heavy type turkeys we calculated similar recipes of compound feeds with replacement of soybean meal for PFA in their composition according to the norms of its introduction (table 2).

As can be seen from the table 2 we did not completely replace soybean meal in the starter recipe, as the rate of introduction of PFA in the turkeys compound feed at the age of 1-4 weeks should not exceed 8,7%. Soybean meal was completely replaced with PFA in the grower, finisher, pre-laying and productive feeds. At the same time, the quality indicators of finished products are in compliance with the minimum nutritional requirements of compound feeds for heavy type turkeys of a given age. The cost of compound feeds with PFA is much lower than similar with soybean meal.

We determined the annual feed consumption of turkeys by growing periods based on the daily feed intake and the duration of each fattening period (Fig. 1).

The cost-effectiveness of replacing soybean meal with PFA in the turkeys compound feed is presented in Figure 2.

Conclusions

Thus, recipes of compound feeds for heavy type turkeys have been developed in accordance with an improved feeding program. Soybean meal has been replaced by a protein feed additive in this recipes. The nutritional indicators of PFA are in compliance with the specified quality, but its cost is much lower than soybean meal. PFA can be manufactured at a feed mill with portion technology by weighing portions of components and mixing in a paddle periodic action mixer. PFA can be used as a part of compound feeds for poultry farms and livestock complexes, feed concentrates for poultry and livestock farms, feed mills with advanced technology, inter-farm or mini-feed mills.

It was proved that compound feeds with protein feed additive had less cost than compound feeds with soybean meal. Besides these compound feeds are in compliance with the turkey feeding standards and restrictions on the introduction of components.

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ОПТИМІЗАЦІЯ СКЛАДУ КОМБІКОРМВ ДЛЯ ІНДИКІВ

Анотація

У статті зазначено, що вітчизняна комбікормова продукція не завжди може конкурувати з високоякісною продукцією іноземних фірм. Однак використання імпортованих кормів призводить до значного зростання їх вартості і як слідство до збільшення собівартості кінцевої продукції.

Встановлено, що для нормального розвитку та реалізації продуктивності індиків повинні отримувати якісний та збалансований за всіма показниками комбікорм. Тому було поставлено задачу розробки рецептів для індиків з використанням високоякісної вітчизняної сировини.

Доведена необхідність визначення повної характеристики компонентів комбікормів для виробництва готової продукції, яка відповідає вимогам нормативних документів та споживача. Існує багато показників та факторів, які не враховуються при розрахунку рецептів, але істотно впливають на якість комбікорму.

Нами були розроблені рецепти повнораціонних комбікормів для індиків важкого типу віком 1...4 тижні, 5...13 тижнів, 14...17 тижнів, 18...30 тижнів та старше 31 тижня за допомогою програмного комплексу «Корм Оптіма Експерт», в ньому закладено принцип розрахунку рецептів за мінімальною собівартістю з урахуванням обмежень вводу кожного компоненту та поживності готового продукту за допомогою лінійного програмування за формулами.

Обґрунтовано доцільність заміни соєвого шроту у рецептах комбікормів для сільськогосподарської птиці через його високу вартість на більш дешеві білкові компоненти.

З метою зниження вартості комбікорму нами було запропоновано оптимальний склад та технологія виробництва білкової кормової добавки (БКД) для заміни в рецептах комбікормів соєвого шроту.

На основі розроблених рецептів комбікормів для індиків важкого типу нами були розраховані аналогічні рецепти комбікормів із заміною в їх складі соєвого шроту на БКД згідно норм її введення. Показники якості готової продукції відповідають мінімальним вимогам поживної цінності комбікормів для індиків важкого типу заданого віку, а вартість комбікормів із БКД значно нижче аналогічних із соєвим шротом. Розраховано річне споживання комбікорму індиками по періодах вирощування.

Ключові слова: індиків, рецепти комбікормів, оптимізація, білкова кормова добавка, шрот соєвий, показники поживної цінності.

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