

Efficiency of using high-protein soybean meal in feeding broilers of cross-breed ROSS-PM3

Vladimir Galkin, Natalya Vorobyova*, and Valentina Chichayeva

Nizhny Novgorod State Agricultural Academy, 603107 Nizhny Novgorod, Russia

Abstract. The use of high-protein soybean meal in broiler diets provided for 38 days of fattening obtaining live weight of 2,336 g, average daily gain in live weight of 60.4 g, which is higher than in the control group by 135 g and 3.5 g, respectively. The highest rates were observed in chickens that consumed compound feed with high protein soybean meal, which was characterized by a high content of crude protein (47.0%) and good protein solubility (77.8%). It is proved that the use of soybean meal with a high content of SP - 47.0% versus 42.0%, increases the live weight of chickens and reduces feed costs per 1 kilo of live weight gain.

1 Introduction

To actualize the genetic potential of modern broiler crosses, more and more demands are placed on the quality of the components that make up the compound feed [1–4]. The leading place among them is occupied by soy and sunflower meal.

The richest sources of essential amino acids, of course, are animal sources of protein. Today, the production of animal and vegetable proteins is 68 million tons per year, including 5.3 million tons of animal protein [5].

Due to the high price, components for the preparation of animal feed with animal protein are very often falsified, so in practice most diets for poultry, especially parent flocks, are composed mainly of plant sources of protein. The biological value of such diets is increased by enrichment with synthetic amino acids [6,7].

Protein of animal origin is more complete due to the wide variety and better ratio of amino acids, their greater bioavailability compared to protein of plant origin, but it is more scarce and expensive.

At present, quite a lot of research has been carried out to study the feeding of poultry by various diets in order to reduce, up to the complete exclusion, protein of animal origin and replace it with vegetable, provided that the biological value of the diets is preserved [8–10].

However, the question of optimal sources of vegetable protein in diets for broiler chickens is not well understood. Therefore, the study of this issue is relevant and important in theoretical and practical terms.

The purpose of these studies was to study the zootechnical and economic indicators of broiler chickens

growing when they are fed compound feed with high protein soybean meal produced by Sodruzhestvo LLC, and its comparative assessment with a meal from another manufacturer.

The content of crude protein in the meal of LLC Sodruzhestvo was 47.0%, in the meal of LLC Ussuriysk it was 42.0%.

2 Materials and methods

The studies were carried out in 2018 in the conditions of JSC “Lindovskaya Poultry Factory - Breeding Plant” on broilers of the ROSS-PM3 cross from Day 1 to Day 38 of fattening.

The birds were kept in the same type of housing with equipment for feeding broilers in Russian-made cages 2B-3. The temperature and humidity conditions, the front of feeding, watering, and also the bird density were the same in the control and experimental groups and corresponded to the recommendations of VNITIP and manufacturers of the ROSS PM3 cross [11].

In four experimental groups there were 70347 goals, and in four control groups - 70208 heads of broiler chickens. Broilers were fed granular compound feed with nutritional value according to the norms of the cross-poultry feed manufacturer. Up to 10 days of age, broilers consumed starter feed, from 11 to 24 days - a grower, then up to 38 days - a finisher. The experimental design is presented in Table 1.

The diet composition of the experimental and control groups is presented in Table. 2.

* Corresponding author: korm4669750@yandex.ru

Table 1. Experiment design.

Group	Feeding Features
Control	The main ration with the introduction of soybean meal produced by Ussuriysk LLC Primorsky Krai
Experimental	The main ration with the introduction of soybean meal produced by LLC Sodruzhestvo Kaliningrad

Table 2. The composition of the rations for the experimental and control groups of broilers

The composition of the feed	Experimental (The main ration with the introduction of soybean meal produced by Sodrugestvo LLC, Kaliningrad), %			Control (the main ration with the introduction of soybean meal produced by Ussuriysk LLC, Primorsky Krai), %		
	starter	grower	finisher	starter	grower	finisher
Wheat	45.11	65.19	70.40	45.02	64.08	70.23
Corn	15.00	-	-	15.00	-	-
Soybean meal	31.10	14.30	5.50	36.20	16.50	6.00
Sunflower meal	-	6.00	8.00	-	6.00	8.00
Bone flour	3.0	5.50	6.00	3.0	5.00	5.50
Sunflower oil	2.8	3.60	3.90	3.3	2.70	3.70
Fodder yeast	-	3.00	4.00	-	3.00	4.00
Lysine	0.06	0.05	0.10	0.08	0.08	0.15
Methionine	0.01	0.03	-	0.02	0.05	0.03
Threonine	0.04	0.06	0.06	0.05	0.07	0.07
Monocalcium phosphate	0.60	-	-	0.65	-	-
Defluorinated Phosphate	-	0.29	0.06	-	0.60	0.06
Salt	0.15	0.01	0.03	0.14	0.02	0.01
Sodium bicarbonate	0.05	0.10	0.20	0.11	0.10	0.20
Sodium sulfate anhydrous	0.19	0.2	0.20	0.15	0.20	0.20
Limestone flour	0.29	0.15	-	0.30	0.10	0.20
Toxout+	0.10	-	-	0.10	-	-
Potassium carbonate	-	-	0.05	-	-	0.15
Mineral mixture	-	0.02	-	-	-	-
Premix 13455	1.50	-	-	1.50	-	-
Premix 09258	-	1.50	-	-	1.50	-
Premix 09259	-	-	1.50	-	-	1.50
Total	100	100	100	100	100	100

3 Results

High protein soybean meal produced by Sodruzhestvo LLC contains 47.0% crude protein, 4.1% crude fiber, 2.1% crude fat (Table 3.) No GMO was found in the meal sample. Soybean meal produced in Ussuriysk contained: 42.0% crude protein, 5.0% crude fiber, 1.9% crude fat. Feeding chickens up to 10 days of age of high protein soybean meal as part of the starter contributed to an increase in their live weight by 1.9%. At 24 days and 38 days of age - by 4.8% and 6.1%, respectively.

When using high-protein soybean meal in the experimental group, the average daily gain in live weight was 60.4 g in total, and was higher than the control by 6.1%. The increased increase in live weight ensured its best conversion. For the entire period of fattening, the cost of feed per 1 kg of increase in live weight in the experimental groups was 1.80 kg, and in the control - 1.87 (or which is 3.9% less than in the control).

Table 3. The chemical composition of soybean meal.

Chemical composition of soybean meal	Experimental group	Control group
Moisture content, %	11.5	11.6
Crude protein, %	47.0	42.0
Crude fiber, %	4.1	5.0
Crude fat, %	2.1	1.9
Soluble protein, %	77.8	73.2
Urease	0.08	0.09
Lysine	2.66	2.42
Methionine	0.57	0.53
Methionine + cystine	1.15	1.08
Threonine	1.56	1.43

The diets of the experimental and control groups were similar in composition, with the exception of soybean meal. Since a higher protein meal was used, this allowed to reduce the input as the meal itself - by 5.1% for the starter, by 2.2% for the grower and by 0.5% for the finisher, as well as the essential amino acids- lysine - by 33, 3% for the starter, 60.0% for the grower and 50.0% for the finisher, methionine - 100, 66.6% for the starter and grower, respectively, threonine - 25.05% for the starter, 16, 6% - for grower and finisher. The composition of the diet for the control groups are shown in table 2.

Table 4. Nutrition of the diet for the experimental group of broilers receiving food with soybean meal (crude protein 47.0% Sodruzhestvo LLC, %)

Feed Nutrition	Types of feed in different periods of fattening, %		
	starter	grower	finisher
Metabolic energy, kcal / 100g	308	309	313
Crude protein	22.94	21.00	18.82
Crude fat	5.07	6.17	6.51
Crude fiber	3.19	4.17	4.22
Linoleic acid	2.52	2.83	3.02
Lysine	1.43	1.31	1.16
Methionine	0.71	0.65	0.60
Methionine + cystine	1.05	0.99	0.91
Threonine	0.99	0.90	0.80
Tryptophan	0.30	0.25	0.22
Arginine	1.48	1.24	1.09
Calcium	0.94	0.86	0.78
Phosphorus	0.80	0.78	0.69
Potassium	0.89	0.70	0.60
Sodium	0.18	0.19	0.22
Vitamins			
A, thousands of international units	15	13.02	9.38
D ₃ , thousands of international units	5.0	5.0	4.2
E, mg	100.0	93.38	56
K, mg	3.00	1.00	1.88
B ₁ , mg	3.00	2.01	1.88
B ₂ , mg	8.01	5.60	6.6
B ₃ , mg	15	9.34	9.34
B ₄ , mg	700.5	840	784
B ₅ , mg	60	37.38	37.38
B ₆ , mg	4	2.8	2.8
B ₁₂ , mg	0.021	0.014	0.014
B _c , mg	1.5	0.94	0.94
H, mg	0.02	0.22	0.14

A decrease in the intake of soybean meal in the diet in the control group did not adversely affect its nutritional value. Nutritional rations for the experimental and control groups are given in tables 4 and 5, respectively.

Table 5. Nutrition of the diet for the control group of broilers receiving food with soybean meal SP 42.0% USURIISK, %

Feed Nutrition	Types of feed in different periods of fattening, %		
	starter	grower	finisher
Metabolic energy, kcal / 100g	300	309	313
Crude protein	22.88	21.00	18.87
Crude fat	5.27	6.31	6.47
Crude fiber	3.26	4.23	4.26
Linoleic acid	2.67	2.94	3.01
Lysine	1.44	1.32	1.18
Methionine	0.71	0.66	0.61
Methionine + cystine	1.05	0.99	0.92
Threonine	0.99	0.90	0.79
Tryptophan	0.29	0.24	0.20
Arginine	1.45	1.27	1.08
Calcium	0.97	0.87	0.73
Phosphorus	0.83	0.78	0.71
Potassium	0.96	0.70	0.62
Sodium	0.18	0.19	0.19
Vitamins			
A, thousands of international units	15	13.02	9.38
D ₃ , thousands of international units	5.0	5.0	4.2
E, mg	100.0	93.38	56
K, mg	3.00	1.00	1.88
B ₁ , mg	3.00	2.01	1.88
B ₂ , mg	8.01	5.60	6.6
B ₃ , mg	15	9.34	9.34
B ₄ , mg	700.5	840	784
B ₅ , mg	60	37.38	37.38
B ₆ , mg	4	2.8	2.8
B ₁₂ , mg	0.021	0.014	0.014
B _c , mg	1.5	0.94	0.94
H, mg	0.02	0.22	0.14

Table 6 presents the zootechnical indicators of broiler fattening using high protein soybean meal.

Table 6. Zootechnical indicators.

Indicators	Experimental group				Mean	Control group				Mean
	1	2	3	4		5	6	7	8	
Group										
Type of housing	chicken cages	chicken cages	chicken cages	chicken cages		chicken cages	chicken cages	chicken cages	chicken cages	
Fattening, head	15999	15972	19202	19174	17586	15239	20042	15443	19484	17552
Density of landing head / m2	35.6	35.5	35.8	35.7	35.6	35.6	35.9	35.6	35.8	35.7
Case,%	1.90	1.70	1.60	1.80	1.75	1.70	2.30	1.50	2.20	1.93
Culling%	2.13	1.79	0.90	1.03	1.46	2.94	1.95	1.92	2.49	2.33
Feeding period, days	38	38	38	38	38	38	38	38	38	38
Net gain, kg	35463	34417	43275	41834	154989	30492	41339	31683	57988	161502
Live weight of 1 head of the main slaughter, g.	2345	2262	2404	2334	2336	2162	2213	2198	2231	2201
The average daily increase in the main slaughter, g	60.7	58.5	62.2	60.4	60.4	55.8	57.2	56.8	57.7	56.9
Feed consumption per batch, kg	64420	62860	76100	74460	277840	57000	78386	57780	76370	269536
The cost of all feed, rub	921653	903749	1082760	1074354	3982517	820530	1125021	829508	1096351	3871411
Conversion	1.82	1.83	1.76	1.78	1.80	1.87	1.90	1.82	1.88	1.87
Feed price, excluding VAT rub / .kg	14.31	14.38	14.23	14.43	14.34	14.40	14.35	14.36	14.36	14.36
The cost of feed per 1 kg of growth, rubles. without VAT	26.04	26.31	25.04	25.68	25.77	26.92	27.27	26.13	26.99	26.83

4 Conclusion

Thus, the introduction into the broiler diets of high protein soybean meal produced by Sodruzhestvo LLC at all stages of feeding increases the productivity of the livestock, improves feed conversion and the use of nutrients. So, the live weight of broilers upon completion of fattening in the experimental group was higher than the control by an average of 135 g, while reducing feed costs by 70 g per 1 kg of gain in live weight. In addition, the introduction of this meal in broiler diets at different stages of fattening can reduce the input of synthetic amino acids into the diets.

References

1. J.C. McKay, *The genetics of modern commercial poultry*, in: *Proc. of the 23rd World's Poultry Congress* (Brisbane, Australia, July 2008) CD-ROM
2. N.V. Vorobyova, V.N. Chichaeva, V.A. Galkin, *The use of "Lysofort dry" when feeding broilers*, *Zootechnics*, **11**, 23-25 (2018)
3. V.A. Galkin, N.V. Vorobyeva, *Influence of the drug "Lysofort" on the growth and meat productivity of broiler chickens*, *Zootechnics*, **11**, 15-17 (2018)
4. I. Egorov, T. Egorova, R. Roshchupkin, S. Kudikov, *High-protein soybean meal in feed for broiler chickens*, *Fodder feed*, **7-8**, 46-48 (2017)
5. T.V. Konobley, *The influence of different conditions of protein nutrition of broiler chickens on meat productivity and economic indicators*, *Bull. of the Lower Volga Agro-University Complex (Zootechnics and veterinary medicine)*, **3(31)**, 1-3 (2013)
6. E. Clarke, J. Wiseman, *Developments in plant breeding for improved nutritional quality of soya beans II. Anti-nutritional factors*, *The J. of Agricultural Science*, **134(2)**, 125-136 (2000)
7. V.I. Fisinin, *The development of broiler poultry in Russia*, *Economics of agricultural enterprises*, **1**, 14-16 (2005)
8. Y.H. Park, H.K. Kim, H.S. Kim, H.S. Lee, I.S. Shin, K.Y. Whang, *Effects of Three Different Soybean Meal Sources on Layer and Broiler Performance*,

- Asian-Australasian J. of Animal Sciences, **15(2)**, 254-265 (2002)
9. V. Rada, M. Lichovnikova, I. Safarik, *The effect of soybean meal replacement with raw full-fat soybean in diets for broiler chickens*, J. of Applied Animal Research, **45**, 112-117 (2017)
 10. V. Meremikwu, H. Ibekwe, A. Esseini, *Improving broiler performance in the tropics using quantitative nutrition*, World's Poultry Science J., **69(3)**, 633-638 (2013)
 11. V. Fisinin, I. Egorov, T. Egorova, *Methodological guidelines for feeding poultry* (2015) 198 p.