International Journal of Agriculture and Environmental Research

ISSN: 2455-6939

Volume: 12, Issue: 04 "July-August 2026"

THE USE OF PEAS COOKED USING DIFFERENT TECHNOLOGIES BY BROILER CHICKENS

[*]Ishmuratov Halyaf Gabdulhaevich

Doctor of Agricultural Sciences, Chief Researcher, Experimental station "Ufa" Ufa Federal Research Center of the Russian Academy of Science, Ufa. Russia.

*Corresponding Author

DOI: https://doi.org/10.51193/IJAER.2026.12401

Received: 03 Jun. 2026 / Accepted: 16 Jun. 2026 / Published: 24 Jul. 2026

ABSTARCT

The development of effective ways to use vegetable protein in poultry farming is impossible without considering modern advances in protein nutrition and new technologies that consider both the qualitative characteristics of protein and a decrease in the level of anti-nutritional substances in leguminous crops. It has been established that technologies for the production and preparation of feed for feeding reduce the influence of these factors. Replacement of 13.75% of soybean meal (phase I) in the complete feed of broiler chickens with 13.95% extruded (experimental II) and heat-treated peas (experimental III) with the addition of 0.05% synthetic methionine, and in phase II – replacement of 20.00% of soybean meal with an adequate amount of extruded (experimental II) and heat-treated peas (III experimental) with 0.05 % synthetic methionine, They had a positive effect on the safety of livestock, an increase in live weight and a reduction in feed costs per 1 kg of increase, which significantly reduced the cost of compound feed and increased the profitability of poultry meat production.

Keywords: recipe, compound feed, broiler chickens, extruded, heat-treated, peas, soybean meal, average daily growth, control slaughter, morphological and chemical composition of carcasses.

INTRODUCTION

High-grade protein nutrition determines the level of productivity, health status and reproductive abilities of poultry. Protein is the most expensive component of diets and the degree of its conversion into proteins of edible parts of broiler chicken carcasses is 15-33%. The use of soybeans and animal feed in poultry diets increases the cost of finished products.

ISSN: 2455-6939

Volume: 12, Issue: 04 "July-August 2026"

An essential reserve for replenishing feed protein is an increase in the acreage for leguminous crops – peas, lupine, forage beans, vetch, soybeans both in the production of concentrated and bulky feeds [1,5,6,8,13]. The problem of partial replacement of soybeans and animal feed in the diets of poultry feeding with leguminous feed from their own production remains relevant today. Experience shows [2,7,10,11,12,19,20,23,24,26,28,29,30,31,32,33] that substitution is successful if there is no anti-nutritional factor, the level, ratio and availability of amino acids are identical, primarily for sulfur-containing (methionine and cystine).

Peas contain lysine and other amino acids, but are poor in methionine, cystine, and tryptophan. There are inhibitors of proteolytic enzymes (trypsin, chymotrypsin and other substances) that reduce catalytic activity, complicate the digestion and assimilation of nutrients.

Heat treatment and extrusion are effective methods of inactivating nutrients and increasing the feed value of peas, and the introduction of synthetic methionine improves the biological usefulness of compound feed [21,22,25,27,34].

The aim of the study was to evaluate the productive effect of extruded and warmed peas with the addition of synthetic methionine instead of soybean meal in complete compound feeds when raising broiler chickens.

The experiment was carried out on broiler chickens of the Smena-2 cross according to the principle of analogues, identical in origin, age, live weight and general development lasting 47 days. 3 groups of day-old chickens of 99 heads each were formed, the content is cellular. According to the scheme of experiments and the accepted daily routine at the Ashkadarskaya poultry farm, chickens were raised and fed in 2 phases: starting (1-4 weeks) and finishing (5-7 weeks). Feeding according to the norms of need, three times a day [3,4,9,14,15,16,17,18].

The scheme of scientific and economic experience is presented in Table 1.

Table 1: Scheme of scientific and economic experience

I - control	99	47	Complete compound feed (PC), in which soybean meal makes up 13.75% (phase I – the starting period) and 20% (phase II – the finishing period) of the weight.
II - experimental	99	47	PC, where soybean meal (13.75%) was replaced by 13.95% extruded peas + 0.05% methionine (phase I), and in phase II, 20.00% soybean meal was replaced by an adequate amount of extruded peas + 0.05% methionine

ISSN: 2455-6939

Volume: 12, Issue: 04 "July-August 2026"

III - experimental	99	47	A PC in which 13.75% soybean meal is replaced by 13.95% heat-treated peas + 0.05% synthetic methionine (phase I), and in phase 20.00% soybean meal is replaced by an adequate amount of heat-treated peas + 0.05% methionine.

As an alternative feed to soybean meal, peas of our own production were used – the Nemchinovsky 817 variety with a trypsin-inhibiting activity of 78 mg in 100 grams of dry matter. The peas were extruded on a KMZ-2U press extruder with a temperature of 100-150 degrees and a pressure of over 50 atmospheres.

The heat treatment of peas was carried out on AVM-0.65 (vitamin flour aggregate) with a temperature at the outlet of the drying chamber up to 100 degrees.

In the first phase, chickens in the control group received 13.75% soy meal as part of a complete compound feed, and the experimental ones instead received extruded (II) and heat-treated peas (III) in the amount of 13.95% by weight. Additionally, the chickens of the experimental groups received 0.05% synthetic methionine. In phase II, 20.00% soy meal was given to group I chickens as part of compound feeds, and experimental (II and III) chickens received the same amount of extruded and heat-treated peas and 0.05% synthetic methionine each (Tables 2 and 3). When feeding poultry in the control and experimental groups, the ration change was carried out on time, according to the recommendations of the All-Russian Scientific Research and Technological Institute of Poultry Farming (VNITIP, 2000).

Live weight, daily gain, livestock safety, feed and protein costs per 1 kg of live weight gain were determined weekly in broiler chickens. It follows from the data that the consumption of mixed feed birds in all groups was almost the same and averaged: Group I - 79.41 g; II -77.65; III -79.83 g.

The average daily increase during the control period was 35.86 g, in the second group - 37.00 g and in the third group -35.97 g, which is 3.08% and 0.29% more than in the first. Biologically complete feeds of plant origin, rich in protein and the presence of amino acids such as lysine, methionine and cystine, played an important role in improving the indicators of average daily growth and, as a result, an increase in the live weight of chickens.

ISSN: 2455-6939

Volume: 12, Issue: 04 "July-August 2026"

Table 2: Recipes of compound feeds for broiler chickens, % (starting period)

The ingredient	Age of the bird (1-4 weeks)		
	I - control	II - experimental	III - experimental
Feed wheat	45.0	44.0	44.0
Barley without film	20.0	20.0	20.0
Sunflower oil cake	5.0	5.5	5.5
Soy meal	13.75	-	-
Extruded peas	-	13.95	-
Peas warmed on AVM*	-	-	13.95
Fish meal	7.5	7.5	7.5
Fodder yeast	3.0	3.5	3.5
Tricalcium Phosphate	1.0	1.2	1.2
Chalk	1.0	0.8	0.8
Methionine	-	0.05	0.05
Premix	0.25	0.50	0.50
Fuza	3.5	3.0	3.0
100 g of compound feed contains:			
exchange energy, kcal	310	311	311
raw protein, %	22.34	20.35	20.35
raw fiber, %	3.41	3.43	3.49
Lysine, %	1.20	1.19	1.19
Methionine, %	0.54	0.50	0.50
Methionine + cystine, %	0.84	0.82	0.82
of calcium, %	1.15	1.13	1.14
total phosphorus, %	0.75	0.79	0.79
sodium chloride, %	0.24	0.24	0.24
Grain feed, %	65	64	64
Meal, %	13.75	-	-
The cake, %	5.0	5.5	5.5
Legumes (peas), %	-	13.95	13.95
Fish meal, %	7.5	7.5	7.5
Yeast, %	3.0	3.5	3.5
Mineral feed, %	5.75	5.50	5.50
Methionine, %	-	0.05	0.05

*AVM - vitamin flour aggregate

ISSN: 2455-6939

Volume: 12, Issue: 04 "July-August 2026"

Table 3: Structure and nutritional value of complete compound feed for the finishing period, %

The ingredient	Age of the bird (5-7 weeks)		
	I - control	II - experimental	III - experimental
Feed wheat	48.08	48.08	48.08
Barley without film	14.9	14.9	14.9
Soy meal	20.0	-	-
Extruded peas	-	20.0	-
Peas warmed on AVM*	-	-	20.0
Sunflower oil cake	6.0	6.0	6.0
Fish meal	5.5	5.5	5.5
Fodder yeast	3.5	3.5	3.5
Methionine	-	0.05	0.05
Limestone	1.40	1.35	1.35
Phosphate	0.6	0.6	0.6
Chalk	0,02	0,02	0,02
Grain feed (cereals), %	62.98	62.98	62.98
Meals, %	26.00	6.00	6.00
Legumes (peas), %	-	20.0	20.0
Animal feed, %	5.50	5.50	5.50
Yeasts, %	3.5	3.5	3.5
Mineral feed, %	2.02	1.97	1.97
Methionine, %	-	0.05	0.05
100 g of compound feed contains:			
exchange energy, kcal	294	296	296
raw protein, %	19.30	18.50	18.50
raw fiber, %	3.91	3.70	3.99
Lysine, %	1.29	1.27	1.25
Methionine + cystine, %	0.78	0.77	0.76
of calcium, %	1.10	1.10	1.10
total phosphorus, %	0.75	0.76	0.77
sodium chloride, %	0.15	0.15	0.15

To assess the meat qualities of the chickens, a control slaughter and anatomical cutting of the carcasses of 47-day-old broilers was carried out. The high yield of edible parts in the gutted carcass was in the II and III experimental groups (993.4 g and 960.1 g) versus 947.5 g in the control. The yield of edible parts increased in these groups, mainly due to the high yield of muscles. The ratio

ISSN: 2455-6939

Volume: 12, Issue: 04 "July-August 2026"

of edible to inedible was high in the II experimental group - 4.61, and in the III and I, respectively, 4.54 and 4.42 (Table 4).

Table 4: Morphological and chemical composition of carcasses

Indicator	I - control	II - experimental	III - experimental
Live weight, g	1738 ± 27.8	1793 ± 25.6	1745 ± 17.9
The mass of the gutted carcass, g % of live weight	1161.70 ±12.6 66.84	1208.67±10.5 67.39	1171.24±11.8 67.12
Muscle mass, g % of the mass of the gutted carcass	717.91±7.3 61.79	749.35±8.04 62.00	729.61±6.62 62.28
Skin with subcutaneous fat, g % of the gutted carcass	189.43±5.2 16.30	198.10±4.3 16.39	190.32±4.6 16.24
Mass of edible parts, g % of the gutted carcass	947.49±8.7 81.56	993.40±9.2 82.19	960.18±9.4 81.95
Bone mass, g % of the gutted carcass	241.21 ± 2.5 18.44	215.24 ± 2.4 17.81	211.4 ± 2.3 18.04
Internal fat mass, g % of the mass of the gutted carcass	27.79 ± 1.4 2.39	31.28 ± 1.5 2.58	27.37 ±2.0 2.34
including edible organs (lungs, kidneys), g	12.3 ± 1.1	13.6 ± 0.9	12.5 ± 0.8
The ratio of edible to inedible	4.42	4.61	4.54
Water, %	75.13	74.75	74.88
Protein, %	21.12	21.23	21.19
Fat, %	2.20	2.18	2.19
Ash, %	0.73	0.98	0.79

Comparing the results of the chemical composition of meat (muscles) of broilers, it can be noted that the meat of chickens of the II and III experimental groups differed in biological value, that is, the ratio of protein to fat was the highest in these groups: 9.74 and 9.67, against 9.60 in I.

The use of extruded peas and synthetic methionine in the experimental II group, instead of soy meal as part of a complete compound feed, contributed to the production of 37.05 g of average daily increase in broiler chickens. At the same time, feed consumption per unit of production was 1.97 kg, livestock safety 96.96%, and in the control group 35.90 g: 2.09 kg and 95.95%.

The results of the control slaughter showed that the highest yield of edible parts as a percentage of the gutted carcass – 82.19 was obtained where extruded peas were used. The ratio of edible to inedible was also high here, 4.61 instead of 4.54. Net income was received from the sale of 1 c of broiler meat: 180 rubles (option) with soybean meal; 246 rubles with extruded peas and 210 rubles with heat-treated peas.

ISSN: 2455-6939

Volume: 12, Issue: 04 "July-August 2026"

Thus, the use of leguminous pea crops (extrusion, heat treatment) instead of soybean meal in the diets of broiler chickens was not inferior in terms of productivity, livestock safety and feed conversion, as well as the optimal ratio of morphological composition of carcasses and meat quality.

REFERENCES

[1]. Kutuzova A. A., Novoselov Yu.K., Garist A.V. and others. Increasing the production of vegetable protein. - M.: Kolos, 1984. — 191 p.

[2]. Fitsev A. I. A new system for assessing the quality of protein in ruminant animal feed / Modern issues of intensification of feeding, animal husbandry and improving the quality of livestock products. Moscow, 1999, pp. 18-19.

[3]. Kalashnikov A. P. and others. Norms and rations of feeding farm animals: A reference manual. Moscow, 2003. 456 p.

[4]. Fisinin V.N., Egorov I. A., Okolelova T. M., Imangulov S. A. Feeding of poultry. – Sergiev Posad. - 2004. – pp. 115-119.

[5]. Ishmuratov H.G., Fitsev A.I., Mannapov A.G., Kosolapov V.M. Mixed and single-species crops of forage crops in solving the protein problem at the stages of biogeocenosis: feed-animal-products. The monograph. Bashkir State Agrarian University. Ufa: Bashgau, 2006. 143 p.

[6]. Mordovin A. N. Substantiation of the directions of innovative development of the technical and technological base of feed production. Candidate of Dissertation Voronezh, 2023.

[7]. Popov A. N., Rozina I. I. Methods of grain feed preparation. Mat. All-Russian Scientific and Practical Conference "Breeding and technological aspects of the intensification of livestock production". Moscow, 2022. pp. 311–316.

[8]. Mukhambetov B., Nasiyev B., Abdinov R., Kadasheva Zh., Mamyrova L. Influence of soil and cli-matic conditions on the chemical composition and nutritional value of kochia prostrata feed in the arid zone of western Kazakhstan. Caspian Journal of Environmental Sciences., 2023, T. 21 (4): 853–863.

[9]. Gadiev R. R., Gayfullina A.R. Productive qualities of broiler chickens when using sodium humate. Proceedings of V. M. Kokov Kabardino-Balkarian State Agrarian University. 2024. No. 2 (44), pp. 41–49.

[10]. Shulaev G.M., Engovatov V.F., Milushev R.K., Betin A.N. A complete feed additive for compound feeds. - 2015. - No. 6. – Pp. 5-6.

[11]. Shulaev G.M., Engovatov V.F., Milushev R.K. BVMC based on soy and lupin // Compound feed. - 2013. - No. 11. – pp. 77-78.

[12]. Shulaev G.M., Engovatov V.F., Milushev R.K., Betin A.N., Votanovskaya N.A. Improving the composition of fortification additives from legumes to replace fish meal in compound

ISSN: 2455-6939

Volume: 12, Issue: 04 "July-August 2026"

feeds // Chief zootechnician. – 2015. - № 9. – pp. 18-24.

[13]. Popov A. N., Sitnikov V.A. Hydrobarothermal treatment of grain feed. The monograph. Publishing house: Perm Institute of the Federal Penitentiary Service. Perm, 2022. – 166 p.

[14]. Mizeva L. N., Sitnikov V.A. The effect of humic acids on the growth and development of broiler chickens. In the collection: Youth Science 2020: Technologies, Innovations. Materials of the All-Russian Scientific and Practical Conference of young scientists, postgraduates and students dedicated to the 90th anniversary of the founding of Perm State Technical University and the 155th anniversary of the birth of Academician D. N. Pryanishnikov. Perm State Agrarian and Technological University named after Academician D. N. Pryanishnikov. - 2020. – pp. 67-72.

[15]. Failures A.A., Sitnikov V.A. The effect of humic acid concentration on the growth and development of broilers. Perm Agrarian Bulletin. – 2020. - № 2 (30). – Pp. 114–121.

[16]. Basharov A. A., Andrianova E. M., Yumaguzin I.F. The results of raising broiler chickens when feeding larvae of the black lion fly. Genetics and animal breeding. 2022. No. 2. pp. 5–12.

[17]. Basharov A. A., Gayfullina A.R., Shagivaleev B.R. The use of acidifiers in feeding young farm animals and poultry. In the book: The science of the young – the innovative development of agriculture. Proceedings of the XII National Scientific and Practical Conference of Young Scientists. Ministry of Agriculture of the Russian Federation; Bashkir State Agrarian University; Council of Young Scientists of the University. 2019. pp. 250–254.

[18]. Khaziakhmetov F., Khabirov A., Avzalov R., Tsapalova G., Basharov A., Tagirov K. He influence of “Stimix zoostim” and “Normosil” probiotics on fecal microflora, hematologic indicators, nutrient digestibility, and growth of mother-bonded calves. Veterinary World. 2020. T. 13. № 6. C. 1091–1097.

[19]. Alam M., Howlider M., Pramanik M. Effects of Exogenous Enzyme in Diet on Broiler Perfor-mance // International Journal of Poultry Science. 2003. - №2 -P. 168–173.

[20]. Феркет П.Р., Миддлтон Т. Антипитательные вещества в кормах /Университет Северной Королины. США. - //Poultry International, 1999.

[21]. Amaefule K. Obioha F. Performance of pullet chicks fed raw or processed pigeon pea (Cajanus cajan) seed meal diets // College of Animal Science and Animal Health, Michael Okpara University of Agriculture, 2004. 14-15.

[22]. Ebsim S. M., Warkentin T. D., H. L. Classen H. L. Energy, protein, and starch digestibility of pea as affected by grind size and cold pelleting in broiler chickens // University of Saskatchewan, Saskatoon, SK, Canada, 2007. 488 p.

[23]. Meng X., Slominski B. Nutritive Values of Corn, Soybean Meal, Canola Meal, and Peas for Broiler Chickens as Affected by a Multicarbohydrase Preparation of Cell Wall

Degrading Enzymes // Poultry Sc. Savoy, Aug 2005. - V. 84. - Iss.8. - P. 1242-1251.

[24]. Moschini M., Masoero F., Prandini A. Raw pea (Pisum sativum), raw Faba bean (Vicia faba var. minor) and raw Lupin (Lupinus albus var. multitalia) as alternative protein sources on broiler diets // Ital. J. Anim. Sci. 2005. - V. 4. - P. 59-69.

[25]. Onu P, Okongwu S. Performance characteristics and nutrient utilization of starter broilers fed raw and processed pigeon pea (Cajanus cajan) seed meal // International Journal of Poultry Science. 2006. - № 5. - P. 693-697.

[26]. Saeed M., Khadiga A. Inclusion of Pigeon Pea (Cajanus cajan) Seed on Broiler Chick's Diet // Research Journal of Animal and veterinary sciences. 2007. -№2.-P. 1-4.

[27]. Stupeliene A., Sasyte V. Comparative evaluation of nutritional value of compound feeds for chicken broilers using thermal treated peas and supplement of enzyme preparation Rovabia Excel AP // Lith. Vet. Academy. -2004. T. 26 (48). -P. 65-68.

[28]. Sugui F., Pastor C. Utilization of pigeon pea seeds as protein supplement in chicken ration // In-ternational Chickpea and Pigeonpea Newsletter. 2004.1. P. 49-51.

[29]. Zaghari M., Borbor S., Rezzaei M. etc Effects of phytase supplementation on nutrients availa-bility and performance of broiler chicks / M. Zaghari, S. Borbor, M. Rezzaei etc. // World's poultry science journal. 2006. - V. 62. - 308 p.

[30]. Zivkovic B., Choct M., Hughes RJ. The new Season Grain Phenomenon: the role of endogenous glycanases in the nutritive value of cereal grainsin broiler chickens // RIRDC Publications, Australia, 2000.

[31]. Waldroup P.W., Bedford M.R., Apajalahti J. Microbial interactions in the response to exogenous enzyme utilization // Enzymes in farm animal nutrition/ CABI Publishing, Oxon, UK, 2001. P. 299-314.

[32]. Zhang Y., Li Z., Zhang Y. (2019). Effects of different levels of peas in the diet on growth per-formance, nutrient digestibility, and immune response of broiler chickens. Poultry Science. 98(10):1783–1791.

[33]. Cross D.E. Herbs, thyme essential oil and condensed tannin extract as dietary supplements for broilers, and their effects on performance, digestibility, volatile fatty acids and organoleptic proper-ties/ D.E Cross, R.M. McDevitt, T. Acamovic// Br. Poultry Sc.- 2011.- V.52, N2.- P. 227-237.

[34]. Effects of feed form on growth performance and processing yields of broiler chickens during a 42-day production period / W. A. Dozier III, K. C. Behnke, C. K. Gehring, S. L. Branton // The Journal of Applied Poultry Research. – 2010. – Vol. 19. – P. 219–226. DOI: 10.3382/japr.201000156.

