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Research Article

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Growth and development of replacement "Rodonit-2" hybrid chickens when feeding with "Lesnov`s ferment"

Akulina Vasilevna Popova[1], Vladimir Viktorovich Pankratov[2], Natalia Matveevna Chernogradskaya[3], Mikhail Fedoseevich Grigoriev[4], Alexandra Ivanovna Grigorieva[5], Valentina Vasilyevna Sysolyatina[6], Victoria Kimovna Evsyukova[7], Darya Ivanovna Stepanova[8], Natalia Alekseevna Sleptsova[9] and Svetlana Innokentievna Stepanova[10]

[1]Cand. of Agricultural Sci., Associate Professor of the Department of General Zootechnics
Yakut State Agricultural Academy
3, Sergelyakh Str., Yakutsk 677007, Republic of Sakha (Yakutia), Russian Federation
[2]Doctor of Agricultural Sci., Professor of the Department "Technology of processing of livestock products and public catering" Yakut State Agricultural Academy
3, Sergelyakh Str., Yakutsk 677007, Republic of Sakha (Yakutia), Russian Federation
[3]Cand. of Agricultural Sci., Associate Professor of the Department of General Zootechnics
Yakut State Agricultural Academy
3, Sergelyakh Str., Yakutsk 677007, Republic of Sakha (Yakutia), Russian Federation
[4]Senior Lecturer of the Department "Environmental Engineering"
Yakut State Agricultural Academy
3, Sergelyakh Str., Yakutsk 677007, Republic of Sakha (Yakutia), Russian Federation
[5]Senior Lecturer of the Department "Higher mathematics"
Ammosov North-Eastern Federal University
48, Kulakovskogo Str., Yakutsk 677013, Republic of Sakha (Yakutia), Russian Federation
[6]Cand. of Agricultural Sci., Associate Professor of the Department "Traditional industries of the North"
Yakut State Agricultural Academy
3, Sergelyakh Str., Yakutsk 677007, Republic of Sakha (Yakutia), Russian Federation
[7]Cand. of Veterinary Sci., Associate Professor of the Department "Traditional industries of the North"
Yakut State Agricultural Academy
3, Sergelyakh Str., Yakutsk 677007, Republic of Sakha (Yakutia), Russian Federation
[8]Cand. of Agricultural Sci., Associate Professor of the Department «Environmental Engineering»
Yakut State Agricultural Academy
3, Sergelyakh Str., Yakutsk 677007, Republic of Sakha (Yakutia), Russian Federation
[9]Cand. of Agricultural Sci., Associate Professor of the Department «Agronomy and chemistry»
Yakut State Agricultural Academy
3, Sergelyakh Str., Yakutsk 677007, Republic of Sakha (Yakutia), Russian Federation
[10]Cand. of Chemistry Sci., Associate Professor of Chemistry Department
Ammosov North-Eastern Federal University
48, Kulakovskogo Str., Yakutsk 677013, Republic of Sakha (Yakutia), Russian Federation

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ABSTRACT.
The article presents the results of the study of the effectof enzyme preparation "Lesnov's ferment" on growth and development of replacement "Rodonit-2" hybrid chickens in the conditions of Yakutia. The study was conducted at the poultry farm "Karbalakh Ptitsa" LLC of the Tattinsky ulus of the Sakha Republic (Yakutia). Two groups of replacement "Rodonit-2" hybrid chickens in the age of 10 days were formed to conduct experiments. Chickens from the control group received the usual commercial diet, while the diet of the experimental group included "Lesnov's ferment" asa supplement at the rate of 5 g of powder per 1 ton of feed. Replacement chickens grown on a diet with ferment were growing by 17.2% more intensively than chickens of control group. The amount of hemoglobin in replacement chickens of the experimental group was higher by 3.2 g/l than that in the control group, indicating a higher level of metabolism. The content of red blood cells in the blood of chickens in experimental group was slightly higher by 0.42*10/l than that in the control group, the content of leukocytes exceeded control by 1.55*109/l, and the content of protein in the blood – by 7.1 g/l. All the blood hematological parameters did not exceed physiological standards. Feed intake was high enough and equaled to 94.6% in the experimental group and 93.7% in the control group. At the same time, the best digestibility of crude protein, fat and fiber was noted in chickens of the experimental group. The balance of calcium and phosphorus was positive in both groups. The digestibility coefficient of nutrients in the experimental group was higher than in the control group: 5.7% with regard to nitrogen and 2.2% with regard to calcium. Feed consumption per 1 head of the replacement chickens in the control group was 7.65 kg, while in the experimental group – 7.91 kgthatwas by 8.7% less than in the control. Thus, the addition to the diet of "Lesnov's ferment" had positive effect on the accumulation of minerals in the body, andcontributed to the increase in growth energy and acceleration of the poultrydevelopment rate.

Key words: Yakutia, chickens, feed additive, growth and development, poultry breeding.

INTRODUCTION.

Poultry breeding is one of the developing sectors of the agro-industrial complex of Yakutia, which gives high-quality meat and eggs valuable for human nutrition.

High genetic indicators of productivity can be achieved only by taking into account all the needs of the poultry. On top of everything else, these requirements include maintaining elements such as quality feed, optimum amount of floor space per chicken, and adherence to appropriate modes of poultry maintenance [KIRICHENKO andSEVOSTYANOVA *et al*., 1990].

Chickens selected for high productivity and viability especially demand special environmental conditions. Thus, even a minor infraction of these conditions (light, temperature, forage, and other regimes) causes a strong body response, which reduces the productivity [BEZUSOV andDEMCHENKO *et al*., 1995].

Poultry breeding in the Far North regions develops in extreme natural and economic conditions. These include, first of all, the harsh climate with low (negative) average annual temperature and sharp fluctuations in barometric pressure, different duration of annual light exposure during polar day and polar night, inaccessibility and focal location of cities and townships, and the lack of own forage base. Compound feeds delivered during summer navigation are stored in warehouses,which certainly reduces their quality, and therefore requires additional increase of their nutritional value [POPOVA, 2009].

In the practice of animal husbandry and poultry breeding, to stimulate metabolism in animals and poultry, a variety of bioeffecting agents are often added into the diet [POPOVA, 2009;GRIGORIEV and CHERNOGRADSKAYA*et al*., 2014;NIKOLAEVA and PANKRATOV*et al*., 2015], including enzyme preparations such as the "Lesnov's ferment". This allows accelerating the growth and development processes, increasing body weight of chickens, and improving meat qualities [LESNOVand LESNOVA, 2002; 2003; 2004].

Currently, there is no information about the effectiveness of the "Lesnov's ferment" enzyme preparation in terms of the growth and development of replacement "Rodonit-2" hybrid chickens in Yakutia. Therefore, the study of the influence of this preparation on the growth and development of young chickens in these conditions becomes particularly relevant.

The aim of the present work was studying the effect of the enzyme preparation "Lesnov's

ferment" on the growth and development of replacement "Rodonit-2" hybrid chickens.

Theresearchobjectivesincluded:

- studying growth and development features of young chickensin experimental groups of "Rodonit-2" hybrid chickens;
- determining digestibility and utilization of diet nutrients;
- studying hematological parameters;
- identifying the efficiency of the "Lesnov's ferment" when breedingreplacement "Rodonit-2" hybrid chickens in the natural climatic conditions of Yakutia.

MATERIALS AND METHODS.

The study was conducted in a poultry farm "KarbalakhPtitsa" LLC of the Tattinsky ulus of the Sakha Republic (Yakutia). Two groups of replacement "Rodonit-2" hybrid chickens at the age of 10 days were formed.

The "Rodonit-2" chicken hybrid was created on PPZ "Sverdlovsky" in the period from 1997 to 2002 on the basis of the "Rodonit" hybrid and genetic material of A, B, C and D lines of "Lohmann Brown" hybrid, delivered from a firm "Lohmann Tierzucht GmbH". The hybrid was obtained through four-way crosses and triple autosexing. The "Rodonit-2" hybrid is highly productive. Egg-laying on the initial laying reaches to 326 eggs, the average egg weight is 64.1 grams, egg-laying peak reaches 96-96.5%. It is characterized by early maturing, adapted to Russian conditions, and has high survivability. The livability of young chickens reaches 98-99%, while that of adult poultry is 97-98%. This hybrid is characterized by high reproductive qualities;raising of young chickens reaches 86-87% [POPOVA, 2009].

Chickens in the control group were fed according to the regular diet (RD). The diet of the experimental group was supplemented by the "Lesnov's ferment" (RD + "Lesnov's ferment") at the rate of 5 grams of powder per 1 ton of complete feed. For comparison, weighing of randomly selected five chickens was carried out each month. The experimental chickens were fed by complete feed, imported from Novosibirsk Feed Mill (Table 1). The main diet consisted ofcomplete feed, sprouted grain, and byproducts. Feeding was conducted twice a day. The RD was consistent with the biological requirements of the poultry and was compiled taking into account recommendations [EGOROV, 2007; KALASHNIKOV *et al.*, 2003].

Table 1. Structure of complete feeds for replacement chickens, %

Components	Chickens age, days		
	1-28	29-60	61-150
Corn	30.0	20.0	41.8
Wheat	30.0	34.0	11.0
Barley	-	10.5	-
Sunflower protein meal	4.1	11.0	13.0
Soybeanprotein meal	22.0	15.0	-
Wheat bran			20.0
Fish meal	11.0	-	5.8
Monocalcium phosphate	0.3	0.3	-
Fine salt	0.2	0.2	-
Premix	1.0	5.0	5.0
Chalk	1.4	1.5	, 1.5
Total	100.0	100.0	100.0
100 g of complete feed contains:			
Exchange energy, kcal/100 g	288.0	307.0	270.0
MJ	1.21	1.28	1.4
Crude protein	22.2	18.2	17.1
Crude fiber	4.0	4.7	6.0
Calcium	1.12	0.69	0.70
Phosphorus	0.71	0.59	0.60

The experimental group of chickens was fed according to the diet with added "Lesnov's ferment" (Table 2). The enzyme preparation "Lesnov's ferment" used in the experiment is available in the form of fragrant powder, which includes drastic cellulosolytic and pectinolytic microorganisms (RF patent 200/019492) [LESNOV, 1998]. This preparation is obtained on the basis of the elk ruminal fluid, as well as from extracts of some specific plants with high biological activity. Consumption of the preparation depends on the amount of feed, 5 g of highly active powder is added to 1 ton of dry raw feed [LESNOVandLESNOVA, 2002; 2003; 2004].

Table 2. Research scheme

Groups	Number of chickens (heads)	Starting age of chickens (days)	Age of chickens ready for picking (weeks)	Feeding conditions
Control	1000	10	17	Basic diet
Experimental	1000	10	17	Basicdiet + "Lesnov's ferment"

The dynamics of live weight of young and adult poultry weretaken into account by weekly (for chickens) and monthly (for adult poultry) individual weighing in the morning before feeding for two consecutive days. The absolute and average daily weight gains as well as relative growth rate were calculated according to the results of weighing.

Feed intake during the entire experimental period was determined on a weekly basis by the difference between the given amount of feed and not eaten remains with the subsequent calculation of the feed cost per 1 head and 1 kg of gain.

Account of the digestibility of nutrients of the diet, the balance of nitrogen, calcium and phosphorus was carried out in each group. For the study, 5 heads of the control poultry population at the age of 14 weeks were selected in each group. Feeding was carried out taking into account the age of the poultry and the amount of feed given and unused residues. Chemical analysis of feed samples and poultry manure was carried out by the following methods: based on dry matter produced by drying in a drying box to a constant mass at a temperature of 100-105^{o}C [LEBEDEV and USOVICH, 1976];

total nitrogen was measured by Kjeldahl technique; crude fat – by Soxhlet method; raw fiber – by a method of Henneberg and Stoman; calcium – by trilonometric method with trilon B; nitrogen-free extracts were calculated by subtracting crude protein, crude fat, and crude fiber from organic matter; crude ash was determined by ashing in a muffle furnace at a temperature of 450-500^{o}C followed by weighing to constant mass; phosphorus content was measured by calorimetric method.

Morphological and biochemical hematological parameters of young chickens were determined at the beginning, in the middle, and at the end of the experiment. Serum and whole blood were used as a material for biochemical screening. Blood was sampled from the axillary vein. Blood sample was used to determine the number of red blood cells and white blood cells using counting method in the Goryaev's camera; level of hemoglobin was determined based on Sali method; total protein – by biuret reaction; calcium – by titrimetric technique with vanadate and molybdenum reagent; and phosphorus – by calorimetric method according to De Waard.

The material obtained in the studies was processed using Microsoft Excel software, as well astreated biometrically using the technique of [PLOKHINSKY, 1969].

RESULTS AND DISCUSSION.

The "Rodonit-2" hybrid chickens were brought from Yakutsk at a weekly age. During the experiments at the "KarbalahPtitsa" LLC poultry farm, the continuous chickens raising scheme was used since 10 to 100 days of age.

One of the chickgrowth and development indicators is live weight and daily gain (Table 3).

Table 3. Dynamics of live weight and average daily gain, g, M±m

Age, days	Groups	
	Control	Experimental
10	55.2±1.6	54.8±1.6
28	163.4±6.7	197.3±1.8*
70	687.0±17.3	922.0±16.4*
90	1136.8±18.8 **	1348.0±21.7*
112	1429.0±18.7	1557.0±21.5*
Averagedailygain, g	14.8	15.09

Notice: * P>0.95

At the beginning of the scientific and economic experiment, live weight of all the chickens at the age of 10 days was almost the same. At the age of 4 weeks, chickens from experimental group with supplementary feeding reached the standard weight earlier (by 7 days) than the chickens receiving the usual diet (197.3 and 163.4, respectively, P>0.95). Thus, the chickens grown on the ration with “Lesnov's ferment” were growing by 17.2% more intensively than those of the control group. It is during the growth of poultry, biochemical processes that provide intensive growth and development of organs and tissues are proceeding more actively. By the period of transfer to the industrial herd the average live weight of young chickens of the experimental group was 1557 g against 1429 g in the control chickens. Thus, the average daily gain in the experimental group was by 9.2% higher than that in the control group.

Blood test of the experimental chickens ("Lesnov's ferment") showed that their morphological and biochemical parameters were higher than those of the chickens in control group for the entire period of observation, and corresponded to physiologicalstandard (Table 4).

It is known that the main function of hemoglobin istransportingoxygen from the lungs to tissues that provides normalization of redox processes. In the chickens of experimental group fed with the "Lesnov's ferment", the amount of hemoglobin was on average higher by 3.2 g/l than that in the control group, indicating a higher level of metabolism in their body.

Table 4. Morphological and biochemical parameters of chickens’ blood, M±m

Indicators	Groups	
	Control	Experimental
Hemoglobin, g/ l	79.15±0.29	82.35±0.35**
Red blood cells, 10 / l	3.09±0.01	3.51±0.016*
Leukocytes, 10^9 / l	37.8±0.19	39.35±0.16*
Total protein, g/ l	35.6±0.18	42.7±0.19**
Calcium, mg/%	9.80±0.07	11.29±0.1*
Phosphorus, mg/%	4.87±0.06	5.92±0.06**
Potassium, mg/%	17.39±0.11	19.41±0.17**
Vitamin a, mcg/%	41.62±0.06	42.73±0.25*
VitaminC, µg/%	44.15±0.04	15.73±0.12*

The groups also differed by the number of red blood cells in circulating blood: the number of red blood cells in the blood of the chickens in the experimental group was slightly higher (by 0.42*10/l), which could be caused by increased cellular respiration and enhancement of redox functions in the body. It is known that the more intensive the biochemical processes in the body, the greater the need for oxygen and nutrients and, therefore, the more active the respiratory function should be. Red blood cells are the main form elements of the blood, which are involved in the transportation of nutrients, while hemoglobin carries oxygen to organs and tissues. The number of erythrocytes and hemoglobin in animals and poultry are of diagnostic importance [STOPICHEV and MAKSYMIUK *et al.,* 2008].

The content of white blood cells in the chickensblood in the experimental group, which was received feed diet with the "Lesnov's ferment", was also slightly higher ($1.55*10^9$/l)that indicatedthe increased protective and trophic functions of their body.

It is known that the protein pattern of poultry in ontogenesis is unstable and depends on various factors such as the level of feeding, age, physiological condition, direction and level of productivity. In our case, in young chickens of the experimental group, the protein content in the blood serum during the test period was significantly higher (7.1 g/l, P>0.99) than in the control group, though did not exceed the physiological standard.

In our studies, the level of calcium in the blood of the chickens in the experimental group was also significantly higher than that of chickens from the control group equal respectively to 11.29 and 9.8 mg%, (P>0.95). Apparently, the calcium content in the chickens' blood of the control group was much lower than the physiological standard, whichmight have affected the growth and development of young poultry.

In our experiments the content of total phosphorus in the blood of young poultry of the experimental group amounted to 5.92 and 4.87 mg%, respectively, while content of potassium was 17.39 and 19.41 mg % (P>0.99).

The quantitative content of vitamins A and C in the blood of the chickens of experimental group was significantly higher than that in the chickens of the control group (P>0.95).

Consequently, feeding chickens by feed, processed with the "Lesnov's ferment" led to an increase in the amount of hemoglobin, red blood cells, white blood cells, total protein, calcium and vitamins A and C in the blood, indicating thereby a pronounced trend towards normalization of protein, mineral, and vitamin metabolism. While conducting the experiment by the conventional method, a physiological test was carried out on the digestibility of nutrients of the diet and the use of nitrogen, calcium, and phosphorus.

Feed intake during physiological experiments was quite high. Consumption of a given amount of feed in the experimental group was 94.6%, while in the control group – 93.7%.

Young chickens of the experimental group were characterized by the highest level of digestibility of crude fat, equal to 78.3 against 75.2% in the control group (Table 5). The increase in the level of digestibility of nutrients in the diet was due to the enhancement in metabolic processes of the body.

Table 5. The digestibility of the feed nutrients in control and experimental groups of chickens, % M±m

Feednutrients	Groups	
	Control	Experimental
Organic matter	76.1±0.91	77.4±0.83
Crude protein	75.6±0.76	76.3±0.79
Crude fat	75.2±0.92	78.3±0.85*
Crude fiber	17.6±0.35	21.1±0.22***
Nitrogen-free extract	84.8±1.32	85.1±1.41

Notice: * P>0.95; * * P>0.999

In terms of the level of raw fiber digestibility, chickens of the experimental group exceeded the control analogues by 3.5% (P>0.999).

Thus, the addition of "Lesnov's ferment" to the diet contributed to more effective digestion of crude protein, crude fat, crude fiber, and nitrogen-free extract.

As known, the digestion and metabolism processes are the main indicators of feeding efficiency and the use of nutrients of the diet. In this regard, it is important to identify the transformation patterns of nitrogenous substances in diets in the digestive tract of young poultry when adding a multienzyme preparation "Lesnov's ferment" to the diet.

The effectiveness of the nutrients' absorption in the body of the poultry under the influence of a certain additive can be assessed based on the balance of substances.

As stated above, the addition of a multienzyme preparation to the diet of the chickens in experimental group has significant effect on the protein digestibility of the feed. The preparation serves an additional source of protein, and so we can estimate the rate of the protein utilization by body. Protein decomposition or deposition can be determined by the nitrogen balance. The nitrogen balance of the "Rodonit-2" hybrid chickens is presented in Table 6.

Table 6. Nitrogen balance in young chickens, g/head/day

Indicators	Groups	
	Control (n=5)	Experimental(n=5)
Nitrogen received with feed	3.30±0.01	3.39±0.02*
Nitrogen excreted with poultry manure	1.84±0.04	1.70±0.06
Nitrogen deposited in the body	+1.47	+1.69
Digestibility coefficient, %	44.4	50.1

The established difference in the nitrogen intake from feed is determined by the increased appetite of young poultry in the experimental group fed by the diet containing an enzyme preparation (9.9%).

Increased intake of nitrogen from feed was not accompanied by large excretion of nitrogen with poultry manure. On the contrary, chickens of the experimental group have accumulated nitrogen by 13% more (P>0.95) than chickens in the control group. It should be noted that the nitrogen balance was positive in the control group of chickens as well.

In general, in the group fed with added fermentthedigestibility coefficient was by 5.7% higher than that in the control.

Therefore, fermented feed had positive effect on the digestibility of nitrogenthat indicated an increased level of metabolic processes in the body.

In our case, the state of mineral metabolism in the growing organism of young poultry is of a certain interest as a factor influencing their growth and development.

Table 7. Calcium balance, g/head/day

Groups	Received with feed	Excretedwithpoultry manure	Deposited in the body	Digestibility coefficient, %
Control	2.33±0.07	0.98±0.03	+1.35±0.02	57.9
Experimental	2.36±0.02	0.94±0.01	+1.42±0.03	60.1

As can be seen from Table 7, the calcium utilization rate was positive in both groups. At the same time, in terms of the digestibility coefficient, the difference in favor of the experimental group was 2.2%.

The phosphorus balance in the control and experimental groups is presented in Table 8.

The intake of phosphorus and accordingly its deposition in the organism by the replacement chickens of the experimental group was higher than that of the chickens in the control group. The digestibility coefficient in young poultry of the experimental group was 46.1 against 44.8% in the control.

Table 8. Phosphorus balance, g/head/day

Groups	Received with feed	Excreted with poultry manure	Deposited in the body	Digestibility coefficient, %
Control	0.87±0.03	0.48±0.02	+0.39±0.02	44.8
Experimental	0.91±0.02	0.49±0.01	+0.42±0.02	46.1

Thus, feeding poultry with fermented feed in general had positive effect on the accumulation of minerals in the body, which contributed to increasing the energy of growth and acceleration of development.

The index of feed consumption per unit of live weight gain is of great practical and economic importance in assessing poultry meat productivity. It is known that the cost of meat production is by 70% determined by the cost of feed. We revealed that the higher the gain in live weight, the lower the feed cost per unit of production. At the same time, as stated above, the gain was achieved not at the expense of greater feed intake, but due to better utilization of nutrients from fermented diet.

The efficiency of metabolism and the intensity of the nutrients utilization are reflected in the feed cost per kg of gain (Table 9).

Table 9. Feed cost and intake (kg) by the "Rodonit-2" hybrid chickens for the entire period of poultry operation

Indicators	Groups	
	Control	Experimental
Feed intake per period, weeks		
1-3	0.35	0.36
4-6	0.77	0.81
7-9	1.19	1.26
10-12	1.55	1.59
13-15	1.86	1.91
16-18	1.93	1.98
Feed consumption per head	7.65	7.91
Feed consumption per 1 kg of gain	5.8	5.3

Feed consumption per 1 head in the control group was 7.65 kg, while in the experimental group it was 7.91 kg. At the same time, due to the increased energy of growth, feed consumption per 1 kg of gain in the poultry of experimental group was by 8.7% less than that in the control.

CONCLUSION.

The use of "Lesnov's ferment" as a supplementary feed had positive effect on the viability of replacement chickens, whose livability was 97.2% in the experimental group, and 95.6% in the control group.

At 4 weeks of age, chickens of experimental group reached the standard weight earlier (by 7 days) than those in the control group receiving the usual diet (P>0.95). Chickens grown on diet with the "Lesnov's ferment" were growing by 17.2% more intensively than chickens of the control group,while at a transfer of young chickens into the market flock (120 days), the daily gain in the experimental group exceeded the control by 9.2%.

The absolute weight of the carcasses in the experimental group exceeded the weight of the poultry carcasses in the control group by 15.3% (P>0.95).

The tendency to an increased level of digestibility of crude protein, fat and fiber was observed in young chickens of the experimental group. The balance of calcium and phosphorus was positive in both groups. At the same time, the coefficient of digestibility of nutrients was higher in young chickens of the experimental group.

Intake of a diet with added enzyme preparation led to an increase in the content of formed elements such as hemoglobin, erythrocytes, leukocytes, total protein, calcium and vitamins in the blood of young poultry of the experimental group, which indicated a pronounced tendency towards normalization of protein-mineral and vitamin metabolism in the body, as well as the increase of the protective and trophic functions of body (leukocytes).

Increased growth intensity of young chickens when feeding with the enzyme preparation provided growth and development intensity of young poultry (average daily gain of 14.8 g in the control group, and 15.02 g in the experimental group). Relatively high live weight of chickens in the experimental group allowed reducing feed cost per 1 kg of gain by 5.8 kg in the control group and by 5.3 kg in the experimental group. The difference amounted to 8.7% in favor of the experimental group, while the growth profitability of young poultry reached 11.1%, which was higher by 6.5% compared to control.

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Information about the authors

AkulinaVasilevna Popova, Cand. Agricultural Sci., Associate Professor of the Department of General Zootechnics, Yakut State Agricultural Academy, Russian Federation, 677007, Republic of Sakha (Yakutia), Yakutsk, 3, Sergelyakhstreet

Vladimir ViktorovichPankratov, Doctor of Agricultural Sci., Professor of the Department "Technology of processing of livestock products and public catering", Yakut State Agricultural Academy, Russian Federation, 677007, Republic of Sakha (Yakutia), Yakutsk, 3, Sergelyakh street

Natalia MatveevnaChernogradskaya, Cand. Agricultural Sci., Associate Professor of the Department of General Zootechnics, Yakut State Agricultural Academy, Russian Federation, 677007, Republic of Sakha (Yakutia), Yakutsk, 3, Sergelyakh street

Mikhail Fedoseevich Grigoriev, Senior lecturer of «Environmental Engineering», Yakut State Agricultural Academy, Russian Federation, 677007, Republic of Sakha (Yakutia), Yakutsk, 3, Sergelyakh street

Alexandra Ivanovna Grigorieva, Senior lecturer of «Higher mathematics», North-Eastern Federal University named after M.K. Ammosov, Russian Federation, 677013, Republic of Sakha (Yakutia), Yakutsk, 48, Kulakovskogo street

Valentina VasilyevnaSysolyatina, Cand. of Agricultural Sci., Associate Professor of the Department "Traditional industries of the North", Yakut State Agricultural Academy, Russian Federation, 677007, Republic of Sakha (Yakutia), Yakutsk, 3, Sergelyakh street

Victoria KimovnaEvsyukova, Cand. of Veterinary Sci., Associate Professor of the Department "Traditional industries of the North", Yakut State Agricultural Academy, Russian Federation, 677007, Republic of Sakha (Yakutia), Yakutsk, 3, Sergelyakh street

Darya Ivanovna Stepanova, Cand. Agricultural Sci., Associate Professor of the Department of «Environmental Engineering», Yakut State Agricultural Academy, Russian Federation, 677007, Republic of Sakha (Yakutia), Yakutsk, 3, Sergelyakh street

Natalia AlekseevnaSleptsova, Cand. Agricultural Sci., Associate Professor of the Department of «Agronomy and chemistry», Yakut State Agricultural Academy, Russian

Federation, 677007, Republic of Sakha (Yakutia), Yakutsk, 3, Sergelyakh street
Svetlana InnokentievnaStepanova,Cand. of Chemistry Sci., Associate Professor of Chemistry Department, North-Eastern Federal University named after M.K. Ammosov, Russian Federation, 677013, Republic of Sakha (Yakutia), Yakutsk, 48, Kulakovskogo street