



*colloquium-journal*

**ISSN 2520-6990**

***Międzynarodowe czasopismo naukowe***



**Agricultural sciences**

**№16(103) 2021**

**Część 2**



**colloquium-journal**

ISSN 2520-6990

ISSN 2520-2480

Colloquium-journal №16 (103), 2021

Część 2

(Warszawa, Polska)

Redaktor naczelny - **Paweł Nowak**  
**Ewa Kowalczyk**

Rada naukowa

- **Dorota Dobija** - profesor i rachunkowości i zarządzania na uniwersytecie Koźmińskiego
- **Jemielniak Dariusz** - profesor dyrektor centrum naukowo-badawczego w zakresie organizacji i miejsc pracy, kierownik katedry zarządzania Międzynarodowego w Ku.
- **Mateusz Jabłoński** - politechnika Krakowska im. Tadeusza Kościuszki.
- **Henryka Danuta Stryczewska** – profesor, dziekan wydziału elektrotechniki i informatyki Politechniki Lubelskiej.
- **Bulakh Iryna Valerievna** - profesor nadzwyczajny w katedrze projektowania środowiska architektonicznego, Kijowski narodowy Uniwersytet budownictwa i architektury.
- **Leontiev Rudolf Georgievich** - doktor nauk ekonomicznych, profesor wyższej komisji atestacyjnej, główny naukowiec federalnego centrum badawczego chabarowska, dalekowschodni oddział rosyjskiej akademii nauk
- **Serebrennikova Anna Valerievna** - doktor prawa, profesor wydziału prawa karnego i kryminologii uniwersytetu Moskiewskiego M.V. Lomonosova, Rosja
- **Skopa Vitaliy Aleksandrovich** - doktor nauk historycznych, kierownik katedry filozofii i kulturoznawstwa
- **Pogrebnaya Yana Vsevolodovna** - doktor filologii, profesor nadzwyczajny, stawropolski państwowy Instytut pedagogiczny
- **Fanil Timeryanowicz Kuzbekov** - kandydat nauk historycznych, doktor nauk filologicznych. profesor, wydział Dziennikarstwa, Bashgosuniversitet
- **Aliyev Zakir Hussein oglu** - doctor of agricultural sciences, associate professor, professor of RAE academician RAPVHN and MAEP
- **Kanivets Alexander Vasilievich** - kandydat nauk technicznych, docent wydziału dyscypliny inżynierii ogólnej wydziału inżynierii i technologii państwowej akademii rolniczej w Połtawie
- **Yavorska-Vitkovska Monika** - doktor edukacji, szkoła Kuyavsky-Pomorsk w bidgoszczu, dziekan nauk o filozofii i biologii; doktor edukacji, profesor
- **Chernyak Lev Pavlovich** - doktor nauk technicznych, profesor, katedra technologii chemicznej materiałów kompozytowych narodowy uniwersytet techniczny ukrainy „Politechnika w Kijowie”
- **Vorona-Slivinskaya Lyubov Grigoryevna** - doktor nauk ekonomicznych, profesor, St. Petersburg University of Management Technologia i ekonomia
- **Voskresenskaya Elena Vladimirovna** doktor prawa, kierownik Katedry Prawa Cywilnego i Ochrony Własności Intelektualnej w dziedzinie techniki, Politechnika im. Piotra Wielkiego w Sankt Petersburgu
- **Tengiz Magradze** - doktor filozofii w dziedzinie energetyki i elektrotechniki, Georgian Technical University, Tbilisi, Gruzja
- **Usta-Azizova Dilnoza Ahrarovna** - kandydat nauk pedagogicznych, profesor nadzwyczajny, Tashkent Pediatric Medical Institute, Uzbekistan

    SlideShare



INDEX COPERNICUS  
INTERNATIONAL

НАУЧНАЯ ЭЛЕКТРОННАЯ  
БИБЛИОТЕКА  
LIBRARY.RU

«Colloquium-journal»

Wydawca «Interdruk» Poland, Warszawa  
Annopol 4, 03-236

E-mail: [info@colloquium-journal.org](mailto:info@colloquium-journal.org)  
<http://www.colloquium-journal.org/>

# CONTENTS

## AGRICULTURAL SCIENCES

<b>Bocharova. M I.,</b> FEATURES OF THE APPROACH TO ASSESSMENT OF FROST RESISTANCE OF BREEDING MATERIAL IN THE GENUS LOLIUM L. ....	3
<b>Грабарієська В.Л.</b> ТЕХНОЛОГІЧНІ ПРИЙОМИ ПІДВИЩЕННЯ ПРОДУКТИВНОСТІ БДЖОЛИНИХ СІМЕЙ.....	6
<b>Hrabarivska V.L.</b> TECHNOLOGICAL TECHNIQUES TO INCREASE THE PRODUCTIVITY OF BEE FAMILIES.....	6
<b>Іванович О.М., Вдовенко С.А.</b> ЕФЕКТИВНІСТЬ ЗАСТОСУВАННЯ ПРЕПАРАТІВ БАКТЕРІЙНОГО ПОХОДЖЕННЯ ПІД ЧАС ВИРОЩУВАННЯ КАПУСТИ БРЮСЕЛЬСЬКОЇ В УМОВАХ ПРАВОБЕРЕЖНОГО ЛІСОСТЕПУ УКРАЇНИ.....	13
<b>Ivanovych O. M., Vdovenko S.A.</b> EFFICACY OF APPLICATION OF PREPARATIONS OF BACTERIAL ORIGIN DURING T HE GROWING OF BRUSSELS CABBAGE IN THE CONDITIONS OF RIGHT-RIVER FOREST STEPPE.....	13
<b>Didur I.M., Shkatula Yu.M., Okrushko S.Y.</b> FORMATION OF SOYBEAN YIELD DEPENDING ON THE USE OF HERBICIDES .....	16
<b>Рудська Н.О.</b> ВПЛИВ ТЕХНОЛОГІЧНИХ ПРИЙОМІВ ТА УДОСКОНАЛЕННЯ СИСТЕМИ ЗАХИСТУ ПОСІВІВ СОНЯШНИКА ВІД БУР'ЯНІВ.....	22
<b>Rudska N.O.</b> INFLUENCE OF TECHNOLOGICAL TECHNIQUES AND IMPROVEMENT OF THE SYSTEM OF PROTECTION OF SUNFLOWER CROPS FROM WEEDS.....	22
<b>Фурман О.В.</b> ФОРМУВАННЯ ФОТОСИНТЕТИЧНОЇ ТА НАСІННЕВОЇ ПРОДУКТИВНОСТІ СОЇ ПІД ВПЛИВОМ ІНОКУЛЯЦІЇ ТА МІНЕРАЛЬНИХ ДОБРИВ В УМОВАХ ЛІСОСТЕПУ ПРАВОБЕРЕЖНОГО УКРАЇНИ .....	30
<b>Furman O.V.</b> PHOTOSYNTHETIC AND SEED PRODUCTIVITY FORMATION OF SOYBEANS UNDER THE INFLUENCE OF INOCULATION AND MINERAL FERTILIZERS IN THE CONDITIONS OF THE RIGHT-BANK FOREST-STEPPE OF UKRAINE .....	30
<b>Tsyhanska O.I., Tsyhanskyi V. I.</b> THE INFLUENCE OF MINERAL FERTILIZERS AND BIOPREPARATION ON THE GROWTH AND DEVELOPMENT OF SOYBEAN PLANTS .....	34
<b>Chudak R. A., Poberezhets Yu.M.</b> THE EFFECT OF DRY EXTRACT OF ECHINACEA PALLIDA ON THE PRODUCTIVITY AND FEED CONSUMPTION OF QUAILS.....	39
<b>Chudak R.A.</b> PRODUCTIVITY OF MEAT QUAILS FED BY BETAINE FEED ADDITIVE AS A PART OF DIETS.....	43



3. Kozyr, V.S., Svezhentsov, A.I. (2002) Praktychni metody doslidzhen u tvarinnycztvi [Practical methods of research in animal husbandry]. Art Press: Dnipropetrovsk, pp. 350-354 p. [in Russian].
4. Rudenko, V.M. (2012). Matematychna statystyka [Mathematical statistics]. Center for Educational Literature: Kyiv, Ukrainian, pp. 234-245. [in Ukrainian].
5. Samorodov V. N., Pospelov S. V. (2013). Results of the study and selection of representatives of the genus *Echinacea* Moench at the Poltava State Agrarian Academy. Materials of the International Scientific Conference Innovative approaches to the study of *Echinacea*. Poltava. 89 - 99. [in Russian].
6. Bohmer M., Salisch H. (2009). *Echinacea purpurea* as a potential immunostimulatory feed additive in laying hens and fattening pigs by intermittent application. *Livest. Sci. V. 122.* 81 – 85.
7. Chudak, R.A., Ushakov, V.M., Poberezhets, Y.M., Lotka, H.I., Polishchuk, T.V., Kazmiruk, L.V. (2020). Effect of *Echinacea pallida* supplementation on the amino acid and fatty acid composition of Pharaoh Quail meat. *Ukrainian Journal of Ecology. Vol. 10 (2):302-307.* DOI: 10.15421/2020\_101.
8. Dehkordi S., Fallah V. (2011). Enhancement of broiler performance and immune response by *Echinacea purpurea* supplemented in diet. *Journal Home. Vol. 10, № 54.* 24 – 32.
9. Maass N. (2013). Effect of *Echinacea purpurea* on oxidative status and meat quality in Arbor Acres broilers. *Journal of the Science of Food and Agriculture. Vol. 93, № 1.* 166 – 172.
10. Razanova O.P. (2018). Improving the quail meat quality by feeding biologically active additives based on the dormancy of bees. *Ukrainian journal of ecology. №8 (1).* P. 631-636. DOI: [http://dx.doi.org/10.15421/2018\\_259](http://dx.doi.org/10.15421/2018_259).
11. Shevchenko L. V., Yaremchuk O. S., Husak S. V. et al. (2017). The content of trace elements and vitamin A in quail eggs under the influence of the complex of glycine trace elements and microbial  $\beta$ -carotene. *Ukrainian journal of ecology. Vol. 7, № 2.* P. 19 - 23. DOI: [http://dx.doi.org/10.15421/2017\\_16](http://dx.doi.org/10.15421/2017_16).

UDC: 637.05:636.52/.58:636.087

**Chudak R.A.**

*Doctor of Agricultural Sciences, Professor  
Vinnytsia National Agrarian University, Vinnytsia, Soniachna str. 3, 21008.  
[DOI: 10.24412/2520-6990-2021-16103-43-47](https://doi.org/10.24412/2520-6990-2021-16103-43-47)*

## PRODUCTIVITY OF MEAT QUAILS FED BY BETAINES FEED ADDITIVE AS A PART OF DIETS

### **Abstract.**

*It was found that the betaine application for quails feeding causes an increase in live weight of 42-day females by 8.2% and males by 6.0%, female gain per kg of growth decreased by 0.38 kg, and male gain per kg of growth decreased by 0.29 kg of feed. Slaughter rates were characterized by an increase in chest muscle weight of 11.4% and thigh muscles by 7.9% with the use of betaine feed supplement. Increased metabolism with an increase in hemoglobin by 2.9% was also found.*

**Keywords:** *quails, feeding, compound feed, productivity, slaughter parameters, morphological and biochemical parameters of blood.*

### **Introduction**

Many researchers are constantly looking for effective growth stimulants of natural origin [2-4, 11, 13, 14]. Betaine should be noted among such feed additives, it is insufficiently researched in animal husbandry [5-7].

It was found that the replacement of choline with betaine led to an increase in breast weight and a decrease in internal fat in broilers. A research conducted by Colorado Quality Research, USA, confirmed improved feed conversion in broilers and increased breast meat yield when choline was replaced by betaine and unchanged methionine levels. In laying hens, betaine helped to reduce the number of eggs that were too large in the later stages of laying [9].

Korean researchers Sun Jin Hur, Han Sul Yang, Gu Boo Park and Seon Tea Joo *Asian-Aust. J.* [7] conducted an experiment to determine the effect of dietary glycine betaine on the quality of pork in different muscle types. It has been studied that in the fatty acid composition dietary glycine betaine helps to increase the ratio of saturated fatty acids (SFA) and reduce unsaturated fatty acids (USFA) in the pigs thighs.

### **Material and methods of research**

The aim of the experiment was to determine the effect of feed additive Betaine on productivity, slaughter quality and hematological parameters of quails.

Zootechnical, statistical, physiological and economic research methods were used to solve these problems.

The use of Betaine in premixes and concentrates significantly improves the preservation of vitamins, increases the shelf life of feeds, concentrates and premixes. Betaine is a donor of methyl groups and acts as an osmoprotector.

One-day quails of the Pharaoh breed were selected on the principle of analogue groups [10], where the breed, age and live weight were taken into account. Two groups were formed, each group included 20 heads.

Quails consumed basic diet (BD) of the Multigain trademark. Betaine was additionally fed to the experimental group of poultry.

The experiment lasted 42 days. The equalization period is 5 days and the main period is 37 days (Table 1).

Table 1

Group	Duration of the period, days		Number of quails, heads	Feeding characteristics
	equalization	main		
1-control	5	37	20	BD (complete feed)
2-experimental	5	37	20	BD+ Betaine (1 kg / t of feed)

The quail population was weighed, and feed consumption was monitored every week, starting from the first day to forty-second day of rearing. The following indicators were determined, i.e., safety, live weight dynamics, average daily, absolute and relative live weight gain, feed consumption per 1 kg of growth according to generally accepted methods.

Biochemical and morphological parameters of blood were researched according to the relevant guidelines, i.e., hemoglobin (using a Sally hemometer); total protein (refractometrically); leukocytes (using of Horiav's camera), etc.

Biometric processing of research results was performed using appropriate techniques [12] and software MS EXCEL, 2010 at three levels of probability: \*P<0.05; \*\* P <0.01; \*\*\* P <0.001.

**Research results and discussion.** Live weight is one of the indicators of meat quail productivity. We have researched the dynamics of live weight of poultry fed additionally by feed additives (Table 2).

It was found that the consumption of the researched feed additive Betaine by 28-day quails of the second group live weight increased by 8.3% (P <0.001) than control counterparts.

Table 2

Live weight and safety of meat quails, g (M ± m, n =20)			
Age of quails, days		Group	
		1-control	2 – experimental
1		8.7 ± 0.16	8.8 ± 0.12
7		21.4 ± 0.32	22.5 ± 0.51
14		52.0 ± 0.75	54.1 ± 0.86
21		93.2 ± 1.14	98.0 ± 2.19
28		145.4 ± 1.64	157.5 ± 1.82***
35	females (n=10)	225.6 ± 2.48	239.1 ± 2.34**
	males (n=10)	198.2 ± 1.75	205.4 ± 1.72*
42	females (n=10)	282.5 ± 2.64	305.7 ± 2.58***
	males (n=10)	232.5 ± 3.14	246.6 ± 3.25*
Safety, %	females (n=10)	98	100
	males (n=10)	98	100

35-day quails were divided into females and males. Thus, females of the second group prevail in live weight by 5.5% (P <0.01) and males by 3.6% (P <0.05) their counterparts. At the end of the experiment the live weight of female quails was bigger by 8.2% (P <0.001) and males quails was bigger by 6.0% (P <0.05) than in the control group.

However, the second group quails have higher survival by 2% than their control counterparts.

We studied the average daily increase in live weight of meat quails under the action of Betaine feed additive (Table 3).

It was found that additional feeding by feed additive increases the average daily gain of the second group of meat quails by 6.7% (P <0.05) than the control analogues.

Table 3

Average daily gain of meat quails, g (M ± m, n =20)			
Age of quails, days		Group	
		1 – control	2 – experimental
1 – 7		1.8 ± 0.06	1.9 ± 0.04
8 –14		4.4 ± 0.18	4.5 ± 0.19
15 – 21		5.9 ± 0.21	6.3 ± 0.23
22 – 28		7.4 ± 0.24	8.5 ± 0.26*
29 – 35	females (n=10)	11.5 ± 0.42	11.7 ± 0.45
	males (n=10)	7.5 ± 0.53	6.8 ± 0.56
36 – 42	females (n=10)	8.1 ± 0.28	9.5 ± 0.30**
	males (n=10)	4.9 ± 0.26	5.9 ± 0.24*
Average by experiment periods	females (n=10)	6.5 ± 0.72	7.1 ± 0.88
	males (n=10)	5.3 ± 0.62	5.7 ± 0.54

36-42-day quails of the 2nd group under the action of "Betaine" in the average daily gain is higher in females by 17.2% ( $P < 0.01$ ) and in males by 20.4% ( $P < 0.05$ ), compared with control analogues.

It was found that the Betaine application increases the absolute growth of females by 8.4% and males by 2.1% compared with the control group.

Feeding by Betaine supplement increases the relative growth of quail (Table 4).

On 36<sup>th</sup> -42<sup>nd</sup> day, quails of the second group, had the relative increase in females by 2.0%, and males by 2.3% ( $P < 0.05$ ) than control.

Table 4

**Relative growth of quails, % (M ± m, n =20)**

Age of quails, days		Group	
		1 – control	2 – experimental
1 – 7		84.4 ± 2.09	87.5 ± 2.11
8 – 14		83.4 ± 2.23	82.5 ± 2.28
15 – 21		56.7 ± 1.91	57.7 ± 1.84
22 – 28		43.8 ± 1.75	46.6 ± 1.68
29 – 35	females (n=10)	43.2 ± 1.53	41.1 ± 1.54
	males (n=10)	30.7 ± 1.44	26.4 ± 1.82
36 – 42	females (n=10)	22.4 ± 0.72	24.4 ± 0.64*
	males (n=10)	15.9 ± 0.76	18.2 ± 0.85*

The Betaine feed additive application for feeding meat quails allows to reduce feed costs by 1 kg of growth (Table 5).

It was recorded that the Betaine reduces feed losses per 1 kg of growth, i.e., females by 7.1% and males by 4.5% than control.

The main indicators of meat productivity of animals and poultry are live and slaughter weight and their slaughter output.

Table 5

**Feed consumption by quails, kg**

Group		Feed consumption, kg					
		for experiment		per 1 kg		per 1 kg of gain	
		total	± control	total	± control	total	± control
1–control	females (n=10)	14.5	-	1.45	-	5.29	-
	males (n=10)	14.2	-	1.42	-	6.34	-
2–experimental	females (n=10)	14.6	+0.1	1.46	+0.01	4.91	-0.38
	males (n=10)	14.4	+0.2	1.44	+0.02	6.05	-0.29

Additional feeding of experimental quails by feed additive Betaine increased pre-slaughter live weight by 7.2% ( $P < 0.05$ ), increased the weight of gutted carcass

by 6.8% ( $P < 0.05$ ) and gutted carcass by 9.2% ( $P < 0.05$ ) than the control indicator (Table 6).

Table 6

**Slaughter indicators of quails, g (M ± m, n = 4)**

Indicator	Group	
	1– control	2 – experimental
Pre slaughter weight	257.5 ± 6.24	276.2 ± 5.46*
Weight of ungutted carcass	242.6 ± 5.16	259.2 ± 4.34*
Weight of semigutted carcass	215.7 ± 5.21	224.8 ± 6.26
Weight of gutted carcass	174.5 ± 4.24	190.6 ± 5.48*
Output of gutted carcass	67.7 ± 1.78	69.0 ± 1.64
Weight of separate edible parts pectoral muscles	45.6 ± 1.26	50.8 ± 1.28*
thigh muscles	26.5 ± 1.15	28.6 ± 1.12

It was found that the feed additives application in the second group increases the weight of pectoral muscles by 11.4% ( $P < 0.05$ ). There is a tendency to increase the weight of the thighs by 7.9% than the control group.

We also researched the effect of Betaine feed additive on the internal organs of quails (Table 7).

Table 7

**Weight of quails' internal organs, g (M ± m, n = 4)**

Organ	Group	
	1-control	2- experimental
Liver	4.8 ± 1.26	5.1 ± 1.38
Pancreas	0.77 ± 0.124	0.80 ± 0.127
Spleen	0.18 ± 0.125	0.19 ± 0.118
Kidneys	1.4 ± 0.32	1.5 ± 0.26
Heart	2.0 ± 0.18	2.2 ± 0.14
Lungs	1.6 ± 0.22	1.7 ± 0.19
Esophagus	1.8 ± 0.34	1.9 ± 0.28
Gizzard	4.1 ± 0.56	4.3 ± 0.34
Glandular stomach	1.0 ± 0.12	1.1 ± 0.15

There is a tendency to increase the weight of internal organs, i.e., liver by 6.2%, heart by 10.0% and gizzard by 4.8% in the second experimental group than control samples.

Blood responds to any changes in the body and supports metabolism and homeostasis.

The effect of feed additives on the biochemical parameters of quail blood was also researched (Table 8).

The blood of the second group quails additionally fed by a feed additive is characterized by the increased content of total protein, glucose, and calcium levels.

Table 8

**Biochemical parameters of quail blood (M ± m, n = 4)**

Indicator	Group	
	1- control	2 - experimental
Total protein, g / l	35.5 ± 3.25	36.3 ± 2.42
Albumins, g / l	17.3 ± 1.62	17.9 ± 1.38
Globulins, g / l	18.2 ± 1.28	18.4 ± 1.36
ALT, units / liter	4.4 ± 1.45	4.5 ± 1.58
AST, units / liter	221.5 ± 22.54	232.6 ± 19.35
Total bilirubin, mmol / l	3.4 ± 0.62	3.3 ± 0.58
Alkaline phosphatase, units / l	1112.5 ± 104.62	1029.5 ± 125.24
Cholesterol, mmol / l	3.1 ± 1.02	3.0 ± 0.72
Triglycerides, mmol / l	2.7 ± 0.74	2.9 ± 0.65
Glucose, mmol / l	5.8 ± 1.05	6.5 ± 1.08
Creatinine, μmol / l	6.2 ± 2.64	6.4 ± 2.42
Urea, mmol / l	1.4 ± 0.27	1.5 ± 0.32
Calcium, mmol / l	2.1 ± 0.42	2.4 ± 0.46

It was found that the application of Betaine feed additive for feeding meat quails of the second group increased the content of erythrocytes by 9.5%, leukocytes

by 4.3% and hemoglobin by 2.2%. However, no significant changes with control were found (Table 9).

Table 9

**Morphological parameters of the experimental poultry blood (M ± m, n = 4)**

Group	Erythrocytes, T / l	Leukocytes, G / l	Hemoglobin, g / l	ESR, mm / hour
1- control	2.3 ± 0.24	33.2 ± 1.56	115.2 ± 2.57	1.7 ± 0.45
2 - experimental	2.4 ± 0.28	34.3 ± 1.42	118.6 ± 2.68	1.8 ± 0.54

Thus, the Betaine application in the quails feeding does not cause probable changes in the blood composition of quails of the second group, the indicators are within the physiological norm.

**Conclusions:**

1. It was found that the live weight of experimental quail females is higher by 8.2% (P<0.001) and males is higher by 6.0% (P<0.05) than in the control group.

2. The Betaine feed additive application increases the absolute growth of females by 8.4% and males by 2.1% compared to the control group.

3. It was recorded that the Betaine application reduces feed consumption per 1 kg of growth of females

by 7.1% and male quails by 4.5% compared to control counterparts.

4. Additional feeding quails of the second group by Betaine increases pre-slaughter live weight by 7.2% (P<0.05), the weight of ungutted carcass by 6.8% (P<0.05), gutted carcass by 9.2% (P<0.05) and pectoral muscles by 11.4% (P<0.05) relative to the control indicator.

5. No probable changes in the internal organs weight and hematological parameters under the action of the researched factor were found.

**Reference**

1. Babkov, Ya.I., Chudak, R.A. (2015) Riven vykorystannia pozhyvnykh rehovyn kormu v orhanizmi svynei za dii kormovoi dobavky betain [The level of

nutrient utilization of feed in the body of pigs under the action of feed additives betaine]. Scientific works: World. Vol. 11. No. 3 (40), p.18-23 [in Ukrainian].

2. Balukh, N.M. (2016). Produktivnist ta masa vnutrishnikh orhaniv perepilok za dii kormovoi dobavky Proenzym [Productivity and weight of internal organs of quails under the action of feed additive Proenzyme]. Scientific Messenger of Lviv National University of Veterinary Medicine and Biotechnologies. Vol. 18. No. 2, p. 3-7 [in Ukrainian].

3. Chudak R.A., Lotka H.I. (2016) Nakopychennia mineralnykh rehovyn u perepelynykh yaitsiakh za pidvyshchenoi dozy vitaminu A [Accumulation of minerals in quail eggs at high doses of vitamin A]. Proceedings of the Ukrainian scientific and practical conference. Environmental problems of agricultural production, p.138-139. [in Ukrainian].

4. Chudak, R. A. (2014). Efektyvnist vykorystannia kormu u perepilok za dii fermentnoho preparatu «Rovabio» [The effectiveness of feeding quails under the action of the enzyme preparation Rovabio]. Collection of Scientific works of Vinnytsia National Agrarian University. Vinnytsia, Issue. 2 (86), p. 22 – 27 [in Ukrainian].

5. Chudak, R.A., Babkov, Ya.I. (2017) Yakisni pokaznyky miasa synei za dii dobavky Betain [Qualitative indicators of pig meat under the action of the additive Betaine]. Agricultural Science and Food Technology. Issue. 2 (96), p. 118 – 124 [in Ukrainian].

6. Chudak, R.A., Poberezhets, Yu.N., Babkov, Ya.I. (2017) Vliyanie kormovoy dobavki «Betain» na myaso-salnyiye kachestva sviney [Influence of the Betaine feed additive on the meat-greasy qualities of pigs]. Topical issues of processing meat and dairy raw materials: collection of scientific papers. Institute of the meat and dairy industry. Minsk, 2017. Issue 11, p.165 – 171 [in Ukrainian].

7. Han Sul Yang, Jeong Ill Lee<sup>1</sup>, Seon Tea Joo, Gu Boo Park Effects of Dietary Glycine Betaine on Growth and Pork Quality of Finishing Pigs. Asian-Aust. J. Anim. Sci. 2009, May. Vol. 22. №. 5, p. 706 – 711.

8. Khorn Tim (2013). Bez vtraty produktyvnosti [Without loss of productivity]. Our poultry farming. May, p.64–65 [in Ukrainian].

9. Khorn Tim. Primenenie naturalnogo betaina v ratsionah sviney [The use of natural betaine in pig diets]. URL: [http:// www.pigua.info/uk/technews](http://www.pigua.info/uk/technews).

10. Kozyr, V.S., Svezhentsov, A.I. (2002) Praktichesni metody doslidzhen u tvarinnycztvi [Practical methods of research in animal husbandry]. Dnipropetrovsk: Art Press, 354 p. [in Russian].

11. Otchenashko, V.V. (2012). Biokhimichni kryterii vitaminnoho zhyvlennia molodniaku perepeliv [Biochemical criteria of vitamin nutrition of young quails]. Modern poultry farming. No. 3, p. 10-13 [in Ukrainian].

12. Plohinskiy, N. A. (1969). Rukovodstvo po biometrii dlya zootehnikov [Biometrics guide for livestock technicians]. M.: Kolos. 256 p. [in Russian].

13. Pololian, Yu. M. (2016). Vplyv probiotyka na khimichni sklad pechinky perepeliv [The effect of probiotics on the chemical composition of quail liver. Scientific and technical bulletin of the research center of biosafety and ecological control of resources of agro-industrial complex of Dnepropetrovsk state agro-economic university]. Vol. 4. No. 1, p. 188–192 [in Ukrainian].

14. Shevchenko, L. V., Yaremchuk, O. S., Husak, S. V. et. al. (2016) Vplyv khalatnykh spoluk mikroelementiv i  $\beta$ -karotynu na morfolohichni ta khimichni sklad yaiets perepeliv [Influence of negligent compounds of trace elements and  $\beta$ -carotene on the morphological and chemical composition of quail eggs]. UKRAINIAN JOURNAL OF ECOLOGY, Vol 7, № 2., p. 5 – 8. [in Ukrainian].