*Bulgarian Journal of Agricultural Science, 22 (Supplement 1) 2016, 3-9*
*Anniversary scientific conference „Animal Science - Challenges and Innovations", November 4-6, 2015, Sofia Agricultural Academy, Institute of Animal Science – Kostinbrod*

# THE EFFECTS OF THE ADDITION OF THE PROBIOTIC "PRIMIX FORSIL" AND THE ADSORBENT "VITACORM REO" ON THE PRODUCTIVITY AND SOME BLOOD PARAMETERS IN GROWING PIGS

L. CAISIN[1], A. DANILOV[2], V. CEBAN[2] and T. SNITCO[1]
[1] *State Agrarian University of Moldova, MD-2049, Mircesti 58, Chisinau, R. of Moldova*
[2] *Scientific and Practical Institute of Biotechnologies in Zootechnics and Veterinary Medicine. MD-25, Maximovca village, District of Anenii-Noi, R. of Moldova*

**Caisin, L., A. Danilov, V. Ceban and T. Snitco**, 2016. The effects of the addition of the probiotic "Primix Forsil" and the adsorbent "Vitacorm REO" on productivity and some blood parameters in growing pigs. *Bulg. J. Agric. Sci.,* 22 (Suppl. 1): 3–9

## Abstract

The aim of the present study was to investigate the effects of the addition of the probiotic "Primix Forsil" and the adsorbent "Vitacorm REO" into the feed for young pigs, using different schemes based on the morphological and biochemical parameters of the animal's blood. The scientific and economic experiment took place at the SE "Moldsiungibrid". Forty hybrid gilts of Landrace x Pietrain breed were used as they were separated into 4 groups on the principle of analogy (10 animals in each group). The gilts in the control group were fed the basic ration, while the pigs in the experimental groups were fed a feed supplemented with different substances, namely: the probiotic "Primix Forsil" (0.5 kg/t) – for the pigs in the first group, the adsorbent "Vitacorm REO" (4.0 kg/t) – for the pigs in the second group, and the probiotic "Primix Forsil" and "Vitacorm REO" in equal proportions – for the pigs in the third group. The feed was balanced according to the feeding norms, and modified in compliance with the animals' age and body weight. The obtained results demonstrated that, the supplementation of the fodders for pigs with the adsorbent "Vitacorm REO" both separately or in combination with the probiotic "Primix Forsil", had a good influence on the general level of blood protein. At the end of the experiment, the albumin level as well as that of the AST (Aspartate Aminotransferase) in the blood of the pigs in the experimental groups were higher in comparison with that in the pigs in the control group.

*Key words:* young pigs, productivity, probiotic, adsorbent, blood parameters

*List of abbreviations*: CG - control group, EG - experimental group, NCB - base mixed feed, FCR - feed conversion ration, AST - aspartate aminotransferase, ALT - alanine aminotransferase, ALP - alkaline phosphatase, PHOS - phosphorus, A/G - the ratio of albumin to globulins

## Introduction

The intensification of breeding technologies and the increase in the number of pigs have resulted in a significant enhancement of the technogenic and microbiological load on the animal organism, which in turn, has caused a disturbance of their digestion and metabolism, a loss of their productivity and the emergence of intestinal infections (Malik, 2001; Subbotin, Danilevsky, 2006; Tmenov and Vanieva, 2013).

In order to increase the nonspecific immunity, to improve the utilization of nutrients in the feed, and to stimulate the growth and development of animals, probiotic, prebiotic, combined preparations and other drugs are used (Fuller, 1992; Yushchuk et al., 2001; Simon et.al., 2001; Danilevskaya et al., 2002, 2003; Egorov et al., 2004; Gryazneva 2005; Buckley, 2006; Walker et al., 2006).

The use of feed probiotics helps to improve the existing system of farm animals' breeding and feeding. They have be-

E-mail: caisinlarisa@mail.ru

come an important component of modern rational feeding of animals (Pavlov et al., 2008; Egorov et al., 2012).

Probiotics feed additives contribute to the correction of digestive processes, affect the immune system as a result of the optimization of the protective functions of the body, and help to restore the biological status. The use of probiotics significantly reduces the cost of the treatment of diseases in animals, increases their productivity and improves the products' quality (Panin, 2008; Volkov et al., 2010; Shvydkoi, 2011; Egorov et al., 2012; Kurmaneva, Bushov, 2012). Because of the widespread proliferation of fungi that produce mycotoxins in grain, mycotoxicoses have been a serious problem in animal husbandry. Their prevalence is linked primarily to the mass destruction of crops by pathogens, which constitutes 25% of the annual global harvest (Tremasov, 2005; Antipov et al., 2007; Ivanov, et al., 2010; Bennet, Klich, 2003).

The consumption by animals of forages polluted by mycotoxins can cause a decrease in their immune system function, injury to their livers and kidneys, deterioration to the reproductive qualities, and an increase of their mortality (Smirnov et al., Zaychenko, Rubezhnyak, 2006). To prevent mycotoxicosis, various enterosorbents are used which reduce the intensity of their adverse effect. However, despite the positive effect based on the removal of toxins from the organism, most of the enterosorbents possess side effects, namely – the high sorption, as a rule, affects not only toxins but also nutrients.

In this regard, the study of the efficiency of the utilization of adsorbents and probiotic feed additives which positively influence the animals' productivity with a simultaneous improvement of the quality of the obtained products, and a decrease in the pathogenic influences of the environment, is actual and is of scientific interest.

Hence, this study was conducted to document the effects of probiotic and adsorbent supplementation on the productivity and some blood parameters in growing pigs.

## Material and Methods

The research was conducted in the conditions of the State Enterprise for Pig Selection and Hybridization "Moldsuingibrid" in the district of Orhei, the Republic of Moldova. Forty Landras x Pietren pigs (of identical growth energy during the preparatory period, and with an average initial weight of 15.86-16.27kg) were divided into four equal groups, and used in a 150-day trial (Ovsianicov, 1976).

Different levels of feed additives were used to study their associated effects on the pigs' performance. The feed for the pigs in the experimental groups $E_1$, $E_2$ and $E_3$ was supplemented with the probiotic preparation "PriMix Forsil" and the adsorbent "Vitacorm Reo" in different quantities according to the scheme (Table 1).

In $EG_1$ the probiotic "PriMix-Forsil" in the quantity of 0.5 kg/t was used, in $EG_2$ the sorbent "Vitakorm Reo" in the quantity of 4.0 kg/t was used, and the mixed fodder for the pigs in $EG_3$ was supplemented with both "PriMix-Forsil" (0.5 kg/t) and the sorbent "Vitakorm Reo" (4.0 kg/t).

The mixed feed for each period of the experiment were prepared using the formulas developed with use of the software program "HYBRIMIN®", and in accordance with the requirements of feeding norms (Kalashnikov et al., 2003). The concentration of the main nutrients in the mixed fodders for different age periods of young pigs, during the first period of the experiment (the growing period, until the pigs reached 40 kg of live weight) was as follows: 12.4 MJ of exchange energy, 13.5% of digestible protein, 0.72% of lysine, 0.51% of methionine + cystine, 0.75% of calcium, and 0.64% of phosphorus. During the second experimental period (when the pigs' live weight was 40-70 kg) the experimental animals received feed with a content of exchange energy of 12.1 MJ, digestible protein of 12.0%, lysine of 0.58%, methionine+cystine of 0.45%, calcium of 0.78%, and phosphorus – 0.66%.

**Table l**
**Scheme of the experiment**

| Group | Number of animals | Feeding features |
|---|---|---|
| CG | 10 | NCB |
| $EG_1$ | 10 | NCB + „PriMix Forsil" *(probiotic) |
| $EG_2$ | 10 | NCB + „Vitacorm Reo" ** (adsorbent) |
| $EG_3$ | 10 | NCB + „PriMix Forsil" + „Vitacorm Reo" |

** Preparation "PriMix Forsil" is a product in the form of dry powder made from mill waste (bran), using a new technology, and lyophilized live microorganisms: Lactobacillus acidophilus – 2x109 CFU/g; Lactobacillus plantarum – 1x109 CFU/g; Lactobacillus fermentum – 5x109 CFU/g; Bifidobacterium bifidum – 3x109 CFU/g.*

*** Adsorbent "Vitacorm REO", (Odessa, Ukraine) according to the procedures set out in TC U 15.7-31253255-001: 2011. It is a complex preparation prepared by mixing dried preparations and products approved for use in the food industry, animal breeding and veterinary medicine. It contains: extruded wheat bran – 10%, bentonite – at least 25%, vermiculite – at least 25%, palygorskite clay – 30%, acidifying agent – 5%, and yeast authorization – 5%.*

During the third experimental period the content of the exchange energy was 11.9 MJ, of the digestible protein – 11.7%, of the lysine – 0.59%, methionine + cystine – 0.44%, calcium – 0.75%, and phosphorus – 0.68%.

The pigs were weighed at the beginning of the experiment and at the end of each of the experimental periods. The weight gain was calculated subtracting the initial weight from the final weight. During the research the accounting of feed palatability was conducted by weighing daily the amount of fodder given to the pigs and the amount of fodder left after feeding. The fodder intake was calculated subtracting the quantity of fodder which was not consumed from the initial quantity of fodder. Feed conversion ratio was calculated by dividing fodder intake by the weight gain.

For the purpose of studying the metabolism intensity and the physiological state in the experimental animals, blood from three heads in each group was taken at the beginning and at the end of the experiment (Svezhentsov et al., 2002).

The data obtained in the experiment were processed using the method of variation statistics (Plokhinsky, 1969; Cucu and Maciuc, 2004) in the Excel program.

The purpose of the present experiment was to study the effect of feed additives on the performance and hematologic indicators of blood in growing pigs. The economic efficiency was also studied.

## Results and Discussion

The difference between the initial and final weights (kg) during the three phases of the experiment was not significant (Table 2).

Throughout the entire experimental period, ADG in $EG_1$ was by 2.1% and in the $EG_2$ by 4.1% higher than in the CG, and by 10.6% higher in the pigs fed the diets supplemented with probiotic and adsorbent ($EG_3$) compared to the pigs fed the basic diet.

The trend was similar for total feed intake (kg) and feed conversion ratio, respectively and was not significant (Table 3).

The total feed intake, average daily feed intake (ADFI, kg) and gain/feed were a little affected by the introduction of the preparations, and was lower in $EG_1$, $EG_2$ and $EG_3$ and higher in CG during the entire experiment.

**Table 2**
**Growth performance, (X± Sx)**

| Specification | Group | | | |
|---|---|---|---|---|
| | CG | $EG_1$ | $EG_2$ | $EG_3$ |
| | *Live weight, kg:* | | | |
| at the beginning of the experiment | 16.11±0.25 | 15.86±0.35 | 16.11±0.32 | 16.27±0.15 |
| at the end of the first growth period | 41.10±1.51 | 41.30±0.31 | 41.70±1.42 | 43.50±1.15 |
| at the end of the second growth period | 67.70±1.20 | 68.10±0.82 | 69.30±1.03 | 71.40±1.38 |
| at the end of the experiment | 93.70±1.81 | 95.00±2.23 | 97.00±2.09 | 98.30±1.82 |
| | Average daily gain, g | | | |
| during the first growth period | 417±25.90 | 424±20.80 | 430±22.01 | 454±24.23 |
| during the second growth period | 504±33.20 | 558±15.80 | 575±25.60 | 581±34.20 |
| during the third growth period | 619±21.59 | 640±43.70 | 660±41.10 | 640±49.70 |
| during the whole period | 517±12.60 | 528±16.40 | 539±13.70 | 547±12.10 |

**Table 3**
**Fodder consumption and fodder conversion, kg**

| Consumption, kg | Group | | | |
|---|---|---|---|---|
| | CG | $EG_1$ | $EG_2$ | $EG_3$ |
| during the first experimental period | 968 | 966 | 964 | 960 |
| during the second experimental period | 1146 | 1145 | 1140 | 1127 |
| during the third experimental period | 1171 | 1166 | 1162 | 1150 |
| during the whole experiment | 3285 | 3277 | 3266 | 3237 |
| (FCR) specific consumption per 1 kg of gain | 4.23 | 4.14 | 4.08 | 3.94 |

A slight decrease in food intake during the second growth period was observed in the experimental group $EG_3$ – it was by 1.7% lower than in the control group. The lowest specific consumption of mixed fodder, required to produce 1 kg of gain with a good feed conversion, was registered in the experimental groups $EG_2$ and $EG_3$, in which it was lower by 3.6% and 6.9% respectively than in the control group. The results corresponds to those obtained in some other experiments, which showed that moderate fodder restrictions in growing and fattening pigs had positively impacted the specific consumption of fodders (Traian, 1992).

In blood profiles, the results of the research showed that at the beginning of experiment the morphological indicators of blood were identical in all the animals (Table 4).

The analysis of the data of blood biochemical indicators at the beginning of experiment (Table 5) showed that the content of the general protein in the pigs in $EG_2$ and $EG_3$ was lower by 19.95g/l and 27.35g/l, respectively, in comparison with the indicators in the animals in the control group; some fluctuations in the content of protein can be connected with the age features occurring in pigs.

At the end of the experiment changes in non-segmented neutrophil values were observed in the animals in all the experimental groups compared with the control group, namely: by $22.67*10^9$/l in $EG_1$ and by $7.67*10^9$/l in $EG_2$, in comparison with the indicators in the CG. In the blood of the pigs in the control group the level of the monocytes content was higher ($7.00*10^9$/l) t. The increase in the number of tissue mac-

**Table 4**
**Values of the morphological indices of blood at the beginning of the experiment, (X±Sx)**

| Indices | Group | | | |
|---|---|---|---|---|
| | CG | $EG_1$ | $EG_2$ | $EG_3$ |
| Erythrocytes, $10^{12}$/l | 8.31±0.74 | 8.63±0.41 | 8.53±0.58 | 8.23±0.35 |
| Hemoglobin, g/l | 116.67±7.57 | 133.30±4.38 | 134.67±4.48 | 121.00±4.16 |
| Color Index, U | 045±0.02 | 0.46±0.01 | 0.47±0.02 | 0.44±0.01 |
| WBC, $10^9$/l | 25.90±2.61 | 27.57±2.18 | 29.33±0.84 | 21.53±0.67 |
| Non-segmented leukocytes, $10^9$/l | 1.33±0.33 | 1.80±0.50 | 2.67±0.67 | 9.33±2.91 |
| Segmented leukocytes, $10^9$/l | 37.00±7.55 | 57.67±6.89 | 30.33±1.67 | 24.33±0.33 |
| Eosinophils, $10^9$/l | 2.33±0.88 | 1.33±0.33 | 2.00±0.80 | 3.00±0.58 |
| Lymphocytes, $10^9$/l | 60.00±8.54 | 49.33±9.94 | 58.67±1.45 | 56.67±4.33 |
| Monocytes, $10^9$/l | 5.23±1.53 | 2.00±0.00 | 6.33±1.86 | 6.67±1.67 |

**Table 5**
**The values of the blood biochemical indices at the beginning of the experiment, (X±Sx)**

| Specification | Group | | | |
|---|---|---|---|---|
| | CG | $EG_1$ | $EG_2$ | $EG_3$ |
| AST, U/L | 106.00± 5.86 | 128.0 0±15.01 | 127.00±12.10 | 128.47±19.37 |
| ALT, U/L | 77.0 0±10.02 | 89.33±2.33 | 85.33±6.17 | 125.33±23.25 |
| ALP, U/L | 548.42±96.07 | 525.10±16.65 | 316.81±73.60 | 150.05±77.9 |
| Calcium, mmol/l | 3.46±0.31 | 3.55±0.35 | 3.70±0.43 | 3.35±0.13 |
| PHOS, mmol/l | 1.67±0.20 | 2.20±0.23 | 1.55±0.17 | 2.26±0.17 |
| Total protein, g/l | 58.75±5.35 | 62.6 3±5.15 | 38.80±10.35 | 31.40±9.27 |
| A/G, g/l | 0.55±0.02 | 0.48±0.03 | 0.50±0.04 | 0.50±0.03 |
| Albumin, g/l | 35.13±0.55 | 32.43±1.13 | 33.37±1.71 | 33.37±1.37 |
| $\alpha_1$,% | 3.73±0.13 | 3.90±0.76 | 3.40±0.10 | 3.43±0.03 |
| $\alpha_2$,% | 21.75±9.15 | 38.17±0.92 | 36.27±1.00 | 35.50±2.16 |
| β, % | 10.83± 3.62 | 12.27±0.70 | 14.63±2.17 | 13.70±2.31 |
| γ, % | 9.87± 3.98 | 13.23±0.79 | 12.33±0.97 | 14.0 0±1.04 |

rophages (monocytes) indirectly suggested a possible latent infection, including an infection of fungal character.

At the end of the experiment the level of the blood total protein in the control group was of 85.43g/l versus 81.73, 86.43 and 86.97g/l in $EG_1$, $EG_2$ and $EG_3$ respectively. An increase in the albumin of the blood serum, namely by 1.00g/l in $EG_2$ and by 1.54 g/l in $EG_3$ compared with the CG, was also observed. Fractions of protein in the experimental groups $EG_1$ and $EG_2$ were identical at the end of the research. The ratio of albumins to globulins was approximately equal in the experimental groups in comparison with the same indicator in the control group (0.36).

In the blood of the experimental pigs the content of ACT (aspartat aminotransferaza) was as follows: 36.00g/l in the CG, and 71.00, 74.00 and 90.00g/l in the experimental groups. It was also observed that the concentration of alkaline phosphatase increased in $EG_1$ and $EG_3$, in which the pigs received a probiotic additive in addition to the basic diets.

The content of calcium in the blood of the experimental pigs in $EG_3$ was by 0.26mmol/l higher than in the control group. Under the influence of supplementation of the ration with "PriMix Forsil" and „Vitacorm Reo" the content of PHOS was 2.56mmol/l in $EG_1$, and 2.52mmol/l in $EG_2$ compared to 1.93mmol/l in the control group (Table 7). Thus, when the content of calcium was reduced in the control group, the content of phosphorus also lowered.

The economic analysis of the results of the experiment showed, that the best results were obtained when the mixed

**Table 6**
**Values of blood morphological indices at the end of the experiment, (X±Sx)**

| Indices | Group | | | |
|---|---|---|---|---|
| | CG | $EG_1$ | $EG_2$ | $EG_3$ |
| Erythrocytes, $10^{12}$/l | 7.03±0.15 | 6.90±0.40 | 7.33±0.23 | 7.07±0.32 |
| Hemoglobin, g/l | 119.33±5.67 | 111.00±5.69 | 115.00±8.08 | 116.00±4.36 |
| Color Index, U | 0.50±0.02 | 0.48±0.01 | 0.47±0.02 | 0.49±0.01 |
| WBC, $10^9$/l | 24.50±2.20 | 25.97±1.72 | 27.57±2.89 | 23.37±2.29 |
| Non-segmented leukocytes, $10^9$/l | 5.00±0.58 | 1.33±0.33 | 0.67±0.67 | 16.00±11.37 |
| Segmented leukocytes, $10^9$/l | 25.33±7.86 | 48.00±9.64 | 33.00±2.65 | 25.67±15.01 |
| Eosinophils, $10^9$/l | 5.67±1.20 | 4.33±1.67 | 7.33±5.84 | 2.67±2.67 |
| Lymphocytes, $10^9$/l | 57.00±8.19 | 45.67±10.27 | 56.00±6.11 | 53.00±4.04 |
| Monocytes, $10^9$/l | 7.00±0.58 | 1.00±0.0 | 2.67±1.67 | 2.67±0.67 |

**Table 7**
**The values of the blood biochemical indices at the end of the experiment, (X±Sx)**

| Specification | Group | | | |
|---|---|---|---|---|
| | CG | $EG_1$ | $EG_2$ | $EG_3$ |
| AST, U/L | 36.00±1.15 | 71.00 ±16.01 | 74.00±21.73 | 90.00±32.1 |
| ALT, U/L | 31.67±10.33 | 60.33±5.24 | 35.33±6.23 | 39.30±3.84 |
| ALP, U/L | 163.94±18.16 | 178.93±24.82 | 167.80±11.50 | 199.80±25.33 |
| Calcium, mmol/l | 2.10±0.03 | 2.11±0.11 | 2.03±0.10 | 2.36±0.14 |
| PHOS, mmol/l | 1.93±0.10 | 2.56±0.27 | 2.52±0.29 | 2.52±0.48 |
| Total protein, g/l | 85.43±3.49 | 81.73±1.88 | 86.43±3.09 | 86.97±5.93 |
| A/G, g/l | 0.36±0.05 | 0.42±0.03 | 0.44±0.12 | 0.53±0.02 |
| Albumin, g/l | 23.97±0.72 | 28.57±2.02 | 27.03±3.96 | 29.77±1.16 |
| $\alpha_1$, % | 5.83±0.64 | 4.93±0.37 | 4.83±0.20 | 4.27±0.19 |
| $\alpha_2$, % | 26.07±0.96 | 30.07±3.90 | 27.27±2.49 | 28.10±2.21 |
| β, % | 23.57±2.48 | 17.37±2.50 | 18.27±0.95 | 13.50±2.07 |
| γ, % | 18.47±1.65 | 18.07±1.35 | 20.23±4.88 | 19.20±3.25 |

**Table 8**
**Economic efficency**

| Indices | Group | | | |
|---|---|---|---|---|
| | CG | $EG_1$ | $EG_2$ | $EG_3$ |
| The absolute growth of body weight on average during the experiment, head/kg | 77.59 | 79.14 | 80.89 | 82.03 |
| Cost of absolute growth, lei | 3026.01 | 3086.48 | 3154.71 | 3199.77 |
| Mixed fodder consumption, kg | 328 | 328 | 330 | 323 |
| The cost of the mixed fodder, lei | 1946.19 | 1971.88 | 1938.41 | 1920.65 |
| The cost of the preparations, lei | - | 57.4 | 73.92 | 56.52+72.24 |
| Gross profit, lei | 1079.82 | 1057.2 | 1142.38 | 1150.36 |
| Net profit, lei | - | -22.62 | 62.56 | 70.54 |

** Cost of 1 kg of body mass – 39 leis; 1 kg of „PriMix Forsil" – 350 leis; 1 kg of „Vitacorm Reo" – 56 leis; 1 kg of mixed fodder – 5 leis, 93 bani*

fodder was supplemented with both the probiotic "PriMix Forsil" and the adsorbent „Vitacorm Reo". The notional profit from their use amounted to 70.54 leis per head.

## Conclusions

The study has revealed that the combined use of the probiotic "PriMix Forsil" at the level of 0.5kg/t and of the adsorbent „Vitacorm Reo" at the level of 4.0kg/t in the mixed fodder has had a positive impact on the growth of the pigs, enhancing their body weight by 4.91%, their daily gain by 5.80% (in group $EG_3$), and has reduced the specific fodder consumption by 0.23kg or 6.90%, showing a nominal profit by 6.53% higher than in the control group.

The supplementation of the mixed fodder for pigs with the probiotic at the level of 0.5kg/t, and of the adsorbent at the level of 4.0kg/t has also had a good influence on the general level of blood protein. At the end of the experiment, an increase in the protein fraction, as well as in AST (aspartate aminotransferase) was observed in each experimental group in comparison with the control group.

## References

**Antipov, V. A., V. F. Vasilyev and T. G. Kutishcheva,** 2007. Mycotoxicosis – an important problem of animal husbandry. *Veterinary science.* **11**: pp. 42-47 (Ru).

**Bennet, J. W. and M. Klich,** 2003. Mycotoxins. *Clinical microbiology. Reviews*. V. **16**, pp. 497-516.

**Gryazneva, T. N.,** 2005. The utilization of the probiotic Biod-5 in the diets for weaned piglets. *Zootechnics*. **8**, p. 15 (Ru).

**Danilevskaya, N. V., M. A. Sidorov and V. V. Subbotin,** 2002. Probiotics in veterinary science. *Veterinary science*, **11** (Ru).

**Danilevskaya, N. V., V. V. Subbotin, O. A. Vashurin and Y. V. Pyatysheva,** 2003. Pharmaceutical stimulation of the productivity of dairy cows using the probiotic Laktobifadol. *Veterinary science*, **2** (Ru).

**Danilevskaya, N. V.,** 2006. Materials of the international scientific and practical conference of the Russian Scientific and Research Institute of Experimental Veterinary Medicine of the Russian Academy of Agricultural Sciences. Moscow, pp. 370-372. (Ru).

**Egorov, I., P. Pankov, B. Rozanov et al.**, 2004. The probiotic laktoamilovarin stimulates the growth of chickens. *Poultry farming,* **8**: 32-33 (Ru).

**Egorov I., T. E. Egorova and B. Rozanov,** 2012. Vegetable feed additive Biostront 510 for broilers. *Poultry farming*, **1**: 17-20 (Ru).

**Ivanov, A. V., M. Y. Tremasov, K. H. Papunidi et al.,** 2010. Methodical recommendations on the prevention of mycotoxicosis in animals. Moscow, pp. 114. (Ru).

**Kalashnikov, A. P., V. I. Fisinin et al.,** 2003. Feeding norms and diets for farm animals. In: A. P. Kalashnikov, *Feeding norms and diets for farm animals*, Moscow, 456 pp. (Ru).

**Malik, N. I. and A. N. Panin,** 2006. Probiotics: theoretical and practical aspects. *Veterinary science of farm animals*, **6**: 48-50 (Ru).

**Yushchuk, N. D. and L. E. Brodov,** 2001. Severe intestinal infections: diagnostics and treatment. *Medicine,* Moscow, 304 pp. (Ru).

**Fuller R.,** 1989. Probiotics in man and animals. *Journal of Applied Bacteriology.* V. 5, **66**: 365-378 (En).

**Ovsyannikov, A. I.**, 1976. Basics of experimental work in animal husbandry. Moscow. (Ru).

**Pavlov, D. S., I. A. Egorov, R. V. Nekrasov, K. S. Laktionov, L. Z. Kravtsova, V. G. Pravdin and N. A. Ushakov,** 2011. Use of biologically active feed additives in order to increase of nutritious properties of mixed fodders and to increase the norms of the supplementation of mixed fodders with oil meal and concentrated feed. *Problems of biology of productive animals*, **1**: 89-92 (Ru).

**Panin, A. N.,** 2008. Probiotics – an integral component of rational feeding of animals. *Poultry and poultry products*, **3**: 13-16 (Ru).

**Plokhinsky, N. A.,** 1969. Manual on biometrics for livestock specialists. *Kolos,* Moscow, 225 pp (Ru).

**Simon, O., A. Jadamus and W. Vahjen,** 2001. Probiotic feed additives – effectiveness and expected modes of action. *Journal of Animal and Feed Sciences.* Vol. **10**: 51–67.

**Subbotin, V. V. and N. V. Danilevskaya,** 2006. Utilization of the probiotic preparation Laktobifadol in poultry farming and animal industry (Ru).

**Tmenov, I. and B. Vaniyeva,** 2013. Diets supplemented with the additive Gidrolaktiv in combination with the antioxidant Epofen. Feeding, fodders and their components. http://www.webpticeprom.ru visited on 09.08.2015 (Ru).

**Traian Stan.,** 1992. Tehnologiia creşterii suinelor. Iaşi, 363 pp. (Ro).

**Tremasov, M. Y.,** 2005. Mycotoxicoses - the problem of their spread and prevention in animal husbandry. In: *Materials of the Russian scientific and practical conference dedicated to the 45th anniversary of the Russian Scientific and Research Veterinary Institute, April 14-15. - Kazan,* pp. 41-51 (Ru).

**Walker, R. and M. Buckley,** 2006. Probiotic microbes: the scientific basis. A report of the American Academy of Microbiology, 22 p. http://www.antibiotic.ru (Ru).