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## The Manifestation Of Reproductive Abilities In Sows While Using Bio Supplements Of Different Composition And Mechanism Of Action In Their Diet.

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### ABSTRACT

In experimental studies conducted on the agro-industrial farm "Novomalyklinsky" in the Ulyanovsk region, it has been found that feeding new generation bio supplements of different composition and mechanism of action (Provagen probiotic, the enzyme-probiotic preparation Bacellus, the silicon-containing prebiotic preparation Coretron, the prebiotic preparation Biocoretron forte, and also the probiotic preparation Provagen in combination with the sorbent prebiotic preparation Coretron) as a mixed feed to sows during their gestation and suckling periods causes an ambiguous rise in the level of saved nutrients and efficiency of metabolic processes in the organism of sows, their fertility and immune status, viability, big fetuses and piglets' vigor.

**Keywords:** pregnant and suckling periods, probiotic, prebiotic, silicon containing supplement, large exterior, milking capacity, fertility, preservation.

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## INTRODUCTION

It can be stated that at present a promising reserve for increasing pork production in terms of industrial technology is the use of probiotic preparations containing various strains of microorganisms that suppress the development of harmful microflora and promote the development of beneficial microflora against the background of mixed feeds of various composition. [1,2].

To a large extent, their use will oust traditional and low-cost products on the market and will provide an alternative to the traditional practice of using antibiotics in animal husbandry and will enhance the manifestation of adaptive ability in animals to the action of stress factors associated with industrial technology of pork production (hypokinesia, early weaning of piglets from sows, rearrangement, transportation, production noise, and others). [3,4].

Prebiotics, that is, preparations of non-microbial origin, have recently been used in animal husbandry along with probiotics. They have a positive effect on the body of the animal, stimulating the growth or activity of lacto and bifidobacteria in its gastrointestinal tract. [5]. The maximum positive effect- an increase in animal productivity is possible with an optimal combination of probiotics and prebiotics in the diet. [6, 7,8,9].

Scientific and technical progress in animal husbandry predetermined the emergence of new bio supplements or various forms of existing ones that require scientific substantiation of their practical application. Such preparations include domestic pro-biotic feed additives Provagen, Bacell, silicon-containing prebiotic preparation Coretron and pre-probiotic Biocoretron-forte.

The feed supplement Provagen contains lyophilized biomass of the bacteria *Bacillus subtilis* BKM B-2287 and *Bacillus licheniformis* BKM B-2414 in an equal ratio, the common biological properties of which are antagonistic activity in relation to the conditionally pathogenic microflora of the gastrointestinal tract of animals and enzyme production. Provagen optimizes the microbial balance in the intestine due to the restoration of normal flora, contributes to an increase in nonspecific resistance of the organism of animals, increasing preservation and growth. One gram of probiotic contains at least  $1 \times 10^9$  CFU of live spore-forming bacteria.

The enzyme probiotic supplement Bacell consists of the microbial mass of the spore-forming bacteria *Bacillus subtilis* 945 (B-5225), the acidophilic bacteria *Lactobacillus acidophilus* L917 (B-4625), *Ruminococcus albus* 37 (B-4292), and sunflower meal. One gram of the supplement contains at least  $1 \times 10^8$  CFU bacteria of each type.

Silicon-containing supplements Coretron [10] and Biocoretron forte [11] based on the natural mineral diatomite have been developed in the accredited testing laboratory for the quality of biological objects for feeding farm animals and poultry at Ulyanovsk State Agrarian University together with the group of the LLC Diatomite factory (the town of Inza). These feed supplements have not only sorption properties (due to the large nanoporosity), but also because of the content (in an accessible form) of silicon (up to 75-88%) and up to 40 macro-microelements in their composition they can be used in rations of animals as sources of minerals. In addition, the biological effect of Bio-Retron-Forte is caused by the effects of biologically active substances (vitamins, chelated microelements and probiotic bacteria) included in its composition, and Coretron supplement, in addition to the presence of mineral substances, has (due to its high acidity) prebiotic properties.

Despite the obvious theoretical and practical validity and feasibility of using the abovementioned supplements, the study of effectiveness of their use in feeding sows in terms of industrial pork production technology in order to more fully realize the genetic potential of their productivity has not been carried out before the present studies.

**The purpose of the study** is to find out the level of nutrient reserve in sows and their efficiency in the dynamics of live weight during the pregnant and lactation periods, reproductive performance, to determine the immune and A-vitamin status, the full value of colostrum and milk, the preservation of pigs under the influence of feed rations of different composition and mechanism of action of dietary supplements.

## MATERIALS AND RESEARCH METHODS

In production settings of the agro-industrial pig farm “Novomalyklinsky” in the Ulyanovsk Region, five experiments were carried out on sows of a three-breed hybrid (Yorkshire, Landrace, Duroc). In each of the experiments with the use of the principle of analogs, the control (I) and experimental (II) groups were formed (8 sows each). In all the experiments the sows were fed with formula feeds according to the SC-1 recipe in the gestation and SC-2 in the suckling periods in accordance with the detailed norms [12], and their piglets were fed up to the age of 28 days with pre-starter formula feed SK-3. In addition, each sow of the experimental group received daily in addition to the diet: in experiment No. 1 - Provagen at a rate of 210 - 220 g per 1 ton of feed, in experiment No. 2 - 4.2 g Bacell (orally), in experiment No. 3 - 30 g of Coretron, in experiment No. 4 - 30 g of Biocoretron forte and in experiment No. 5 - 30 g of Coretron in combination with Provagen at a rate of 210 - 220 g per 1 ton of formula feed. Control groups of animals did not receive any preparations.

Changes in the number of microorganisms in the feed, their genus and species identification were determined in the microbiological laboratory of the university. The morphological composition of blood and the biochemical composition of its serum – with the use of the BIOM-01 analyzer. The live weight of piglets, sows, their reproductive capacities, the composition of colostrum, milk were determined according to generally accepted methods in animal husbandry. The content of vitamin A in the liver was determined by high performance liquid chromatography; biometric processing of the obtained data was done with Microsoft Excel 2007.

## RESEARCH RESULTS AND DISCUSSION.

The application of probiotic preparations of Provagen and Bacell lard, pre-probiotic silicon-containing supplements of Coretron and Biocoretron-forte, as well as probiotics of Provagen, combined with the adsorbent prebiotic supplement of Coretron in the diets of sows during the gestation and suckling periods had an ambiguous effect on the state of microbiocenosis of formula feed fed. If 1 g of the control variant of the feed contains 1302500 CFU of microorganisms, the addition of bio preparations caused a significant decrease in its contamination with microorganisms. Thus, the enrichment of the feed with Provagen reduced its bacterial contamination by 52 times, with the enzyme-probiotic preparation Bacell by 682 times, the sorbent supplement Coretron by 33.3 times, with Biocoretron forte by 48.3 times and with probiotic Provagen in combination with the sorbent preparation Coretron by 71.3 times. Moreover, in the control variant of the feed and in the variant with addition of Coretron, no lactobacilli were detected, whereas in other variants of the feed there were 1 g from 1550 to 19000 CFU. Lactobacilli inhibit the growth of disease carriers by producing lactic acid, participate in the metabolism of proteins, fats, carbohydrates, nucleic and bile acids, activate the immune system, prevent the formation of protracted forms of intestinal diseases by increasing the overall resistance of the body, bind harmful radicals of oxygen for bifidobacteria. Feeding the sows with control feed and formula feed sanitized to a different extent led to an ambiguous effect on the dynamic pattern of their live weight. If at the beginning of the experiment the live weight of the sows of the compared groups in each experiment was relatively the same, then in the last period of gestation the pattern of its increase in the sows of the experimental groups was clearly seen. For 100 days of gestation, the average daily gain, which characterizes the level of assimilation processes in the body of sows consuming Provagen, was 422.5 g, which is 19.42% more than in control animals (353.8 g), but 1.75% less than in the sows that consumed the enzyme-probiotic supplement Bacell. The average daily gain of the sows consuming the formula feed enriched with the prebiotic silicon-containing supplement Coretron was 391.3 g, which is 10.6% more than the control counterparts. With the introduction of the supplement Biocoretron forte into the diet, their average daily gains were 15.88% (410.0 g) higher than those of the sows of the control group. In the sows of the experimental group in experiment No. 5, which were fed with “Coretron” in combination with Provagen, this indicator was 436.3 g, which is 23.32% more than in the control group. Greater live weight in sows of the experimental groups was in the period of lactation. During this period, the sows of the control groups with 10.63 piglets in the litter had noticeably greater live weight losses (“losses from the body”) than the sows of the experimental groups having more piglets in the litter (11.37 ... 13.62 heads). At the same time, the smallest body weight loss over the lactation period was observed in sows consuming Provagen in combination with Coretron (experiment No. 5). In relation to the sows of the control group, their live weight loss with a greater fertility was by 3.13 kg (22.35%) less. In sows that consumed the feed supplements of Provagen, Bacell, Coretron and Biocoretron forte and having the litter by 7.01 ... 22.30% more piglets than control sows, the weight loss during the period of lactation was 9.85 ; 17.86; 11.64 and 8.93% less ( $P < 0.01-0.001$ ), which can be explained by the great reserve of nutrients in their body during the period of gestation and the best efficiency of metabolism.

Consequently, the application in the diet of sows probiotic preparations of Provagen and Bacell, the silicon-containing supplements of Coretron and Biocoretron forte, as well as Provagen in combination with the adsorbent prebiotic mineral supplement of Coretron improves the full value of feeding, improves assimilation processes in their body, respectively, results in a greater reserve in the gestation period of nutrients in their bodies and at the same time provides significantly less loss of live masses for the most intense period of their lactation. At the same time, these changes were most pronounced during the enrichment of the formula feed with the probiotic preparation Provagen in combination with the prebiotic adsorbing mineral supplement Coretron.

The use bio supplements Provagen, Bacell, Coretron, Biocoretron forte, and also Probiogen in combination with the addition of Coretron in the diets of sows also had a positive effect on their reproductive function: their fertility increases, the number of viable pigs increases, the embryonic intensity of their growth and big fetuses (table 1).

The sows of experimental groups No. 1,2,3 and 4 had by 17; 19; 6 and 15 heads, or 20.00; 22.35; 7.06; 17.64%, more live piglets. At the same time, the highest fertility rate of live piglets was found in the sows of experiment No. 5, who were fed with the formula feed, enriched with Provagen in combination with the supplement Coretron (by 28.23% more than in the control group). In general, for all the experiments, the rate of stillborn piglets in sows in the experimental groups was from 2 to 11 heads, which is 7.50 ... 1.25 times less than in the control group. The big fetuses of pigs in sows who consumed feed with a complex of bio supplements was significantly more (1.17 ... 1.23 kg) than that of the control groups (1.13 kg).

We have determined the biochemical composition of the daily volume of colostrum and milk of sows, which the growth intensity and preservation are largely dependent on in the suckling period. It was found that in sows of different groups the content of substances in colostrum was different (table 2). Thus, the proportion of dry matter in the colostrum of sows of the experimental groups exceeded that of the control groups in experiment No. 1 by 5.06%, in experiment No. 2 by 7.98, in experiment No. 3 by 3.26, in experiment No. 4 by 5.81 and in experiment No. 5

**Table 1: Reproductive capacity of sows**

Group	Number of piglets in litter, heads		Big fetuses, kg	Weight of the nest of pigs, kg		Live weight of a pig in 28 days, kg	Number of piglets in 28 days, heads	Preservation of pigs, %
	total	including live ones		at birth	in 28 days			
<b>Experiment 1. (Provagen)</b>								
I-C	12,50 ±0,42	10,63 ±0,38	1,13 ±0,02	12,05 ±0,50	40,38 ±2,60	4,142 ±0,02	9,75 ±0,59	91,72
II-E	14,25 ±0,73***	12,75 ±0,58**	1,21 ±0,02*	15,39 ±0,74**	61,70 ±2,05***	4,936 ±0,04***	12,50 ±0,54*	98,04
<b>Experiment 2. (Bacell)</b>								
I-C	12,50 ±0,42	10,63 ±0,38	1,13 ±0,02	12,05 ±0,50	40,38 ±2,60	4,142 ±0,02	9,75 ±0,59	91,72
II-E	14,50 ±0,73*	13,00 ±0,35***	1,24 ±0,02***	16,05 ±0,83***	60,70 ±3,49***	4,856 ±0,03***	12,50 ±0,82*	96,15
<b>Experiment 3. (Coretron)</b>								
I-C	12,50 ±0,42	10,63 ±0,38	1,13 ±0,02	12,05 ±0,50	40,38 ±2,60	4,142 ±0,02	9,75 ±0,59	91,72
II-E	12,75 ±0,31	11,37 ±0,80	1,17 ±0,02	13,31 ±0,44	51,37 ±2,95**	4,698 ±0,06***	10,88 ±0,69	95,60
<b>Experiment 4. (Biocoretron forte)</b>								
I-C	12,50 ±0,42	10,63 ±0,38	1,13 ±0,02	12,05 ±0,50	40,38 ±2,60	4,142 ±0,02	9,75 ±0,59	91,72
II-E	12,75 ±0,49**	12,50 ±0,38**	1,21 ±0,02**	15,13 ±0,63**	59,24 ±3,15***	4,936 ±0,05***	12,00 ±0,63*	96,00
<b>Experiment 5. (Coretron+Provagen)</b>								

I-C	12,50 ±0,42	10,63 ±0,38	1,13 ±0,02	12,05 ±0,50	40,38 ±2,60	4,142 ±0,02	9,75 ±0,59	91,72
II-E	14,63 ±0,87*	13,62 ±0,68**	1,23 ±0,01***	16,78 ±0,48***	69,00 ±3,50***	5,257 ±0,03***	13,13 ±0,74*	96,33

Here and further: \*P<0,05; \*\* P<0,01; \*\*\*P<0,001

By 7.58%. The content of organic substances: protein, respectively, by 5.46; 10.41; 4.90; 6.02; 9.94% and correspondingly fat by 6.72; 7.42; 1.96; 8.40; 6.58% and milk sugar by 2.35; 2.82; 1.08; 2.12; 3.06%. Due to the higher content of protein, fat and lactose, the gross energy in the daily volume of colostrum of these sows was greater than that of the control group counterparts. These results indicate an increase in the usefulness of sows' colostrum under the influence of probiotic and prebiotic preparations due to the improvement of metabolic processes in their bodies. The same differences are observed in the chemical composition of milk, however, unlike colostrum, the sows' milk of the compared groups contained less dry substances due to a twofold decrease in its protein content, and the content of fat and lactose was at the same level as their content in colostrum.

As for the accumulation of vitamin A in the liver of newborn piglets and weaned piglets, its content in the liver of piglets in contrast to the experimental groups of sows was correspondingly more than 21.10%; 25.30; 10.80; 23.28 and 22.80% in newborn piglets and by 19.64%; 21.66; 13.37; 21.10 and 20.25% in weaned piglets versus piglets from the control groups of sows. This is explained by the better transformation of carotene into vitamin A, which is caused by the sows' consumption of combined feed enriched with bio supplements.

**Table 2: Composition of colostrum and milk produced by sows and vitamin A content in the liver of piglets**

Group	Colostrum composition				Milk composition				Vitamin A content in 1 g of the liver of piglets, mkg	
	Dry matter, %	Protein, %	Fat, %	Lactose, %	Dry matter, %	Protein, %	Fat, %	Lactose, %	New born	Weaned piglets
<b>Experiment 1. (Provagen)</b>										
I-C	26,68± 0,16	14,29± 0,11	7,14± 0,08	4,25± 0,10	19,84± 0,16	7,05± 0,08	7,08± 0,10	4,70± 0,02	27,40± 1,07	45,47± 1,92
II-E	28,03± 0,03***	15,07± 0,07***	7,62± 0,04***	4,35± 0,02	20,45± 0,06**	7,25± 0,05*	7,39± 0,02**	4,81± 0,02***	33,18± 2,53	54,40± 2,00*
<b>Experiment 2. (Bacell)</b>										
I-C	26,68± 0,16	14,29± 0,11	7,14± 0,08	4,25± 0,10	19,84± 0,16	7,05± 0,08	7,08± 0,10	4,70± 0,02	27,40± 1,07	45,47± 1,92
II-E	28,81± 0,26***	15,78± 0,29***	7,67± 0,06***	4,37± 0,01	20,66± 0,13**	7,28± 0,04*	7,56± 0,10***	4,82± 0,01***	34,33± 0,68*	55,32± 1,89*
<b>Experiment 3. (Coretron)</b>										
I-C	26,68± 0,16	14,29± 0,11	7,14 ±0,08	4,25± 0,10	19,84± 0,16	7,05± 0,08	7,08± 0,10	4,70± 0,02	27,40± 1,07	45,47± 1,92
II-E	27,55± 0,24*	14,99± 0,09***	7,28± 0,09	4,30± 0,06	20,11± 0,07	7,13± 0,08	7,25± 0,05	4,75± 0,04	30,35± 2,32*	51,55± 1,96*
<b>Experiment 4. (Biocoretron forte)</b>										
I-C	26,68± 0,16	14,29± 0,11	7,14± 0,08	4,25± 0,10	19,84± 0,16	7,05± 0,08	7,08± 0,10	4,70± 0,02	27,40± 1,07	45,47± 1,92
II-E	28,23± 0,03***	15,15± 0,02***	7,74± 0,04***	4,34± 0,07	20,35± 0,07*	7,20± 0,02	7,34± 0,08	4,80± 0,02**	33,78± 1,30*	55,07± 1,86*
<b>Experiment 5. (Coretron+Provagen)</b>										
I-C	26,68± 0,16	14,29± 0,11	7,14± 0,08	4,25± 0,10	19,84± 0,16	7,05± 0,08	7,08± 0,10	4,70± 0,02	27,40± 1,07	45,47± 1,92
II-E	28,70± 0,15***	15,71± 0,15***	7,61± 0,04***	4,38± 0,02	20,75± 0,16**	7,30± 0,03*	7,61± 0,16**	4,83± 0,01***	33,64± 1,82*	54,68± 1,70*

By the time of weaning piglets (28 days), their preservation rate in the control groups of sows was 91.72%, and in the experimental group of experiment No. 1 - 98.04, experiment No. 2 - 96.15, experiment No. 3 - 95.60, experiment No. 4- 96.00% and experiment No.5- 96.33%, i.e. the mortality rate was 1.11 ... 1.34 times, or 11.59-34.67%, less. At the same time, the weight of 1 pig at weaning in the experimental groups of sows was 4,698–5,257 kg, which is more by 0,556-1,115 kg, or by 13.42-26.92%, and the number of remaining piglets per sow by 11.54— 34.61% more than in the control groups ( $P < 0.05-0.001$ ).

Because of this, the weight of the nest of piglets at the age of 28 days in the experimental groups of sows exceeded significantly ( $P < 0.01-0.001$ ) that of the control group, respectively, by 52.80%; 50.32; 27.22; 46.71 and 70.88%, indicating a better development of their higher milk yield of sows. At the same time, the weight of the nest of piglets of sows that received Provagen with the silicon-containing supplement Coretron was noticeably larger.

The obtained results of reproductive indicators of sows suggest that the use of all the preparations in their diet improves the microbiocenosis of the feed, and hence the microbiocenosis of the digestive tract, and reduces the toxicological load on the body, enhances its assimilation processes and the efficiency of metabolism, which is manifested in an increase in their body weight in the period of gestation and the reduction of its losses in the period of lactation, has a positive effect on embryonic and postembryonic growth, development and preservation of litter.

Along with this, we carried out studies of the morpho-biochemical composition of the blood of sows during their most physiologically intense periods — the 100<sup>th</sup> day of gestation, the 5<sup>th</sup> day of lactation, and on the day of weaning piglets (28 days).

It was established that the sows of the experimental groups in terms of the morphological composition of the blood and the biochemical composition of its serum were superior to the sows of the control groups. So, on the 100<sup>th</sup> day of gestation, their blood had more red blood cells by 10.24-23.96%, hemoglobin by 3.49-25.26, leukocytes by 11.06-26.44%, and the protein content in the blood serum by 1.14-7.15 g / l. In the total protein content, there is a significant ( $P < 0.01-0.001$ ) increase in albumin by 4.40-9.73 g / l, an increase in the albumin-globulin ratio from 0.74 to 1.20 and a higher content of class A immunoglobulins is observed, M, G, which, along with an improvement in the morphobiochemical composition of blood, indicates an increase in redox and assimilation processes in sows and is confirmed by a more intensive growth rate of their body weight (by 4.00-7.87 kg).

A similar pattern of changes in the blood status in sows of the compared groups is manifested in the lactation period. So, by the 5<sup>th</sup> day of lactation, the sows of the experimental groups in the number of hemoglobin and leukocytes significantly ( $P < 0.05-0.001$ ) exceeded that of the control one, by 2.60-20.21% and 4.76-24.05%, respectively. In the period of gestation, there is also a significant ( $P < 0.01-0.001$ ) increase in total protein by 1.23-9.67 g / l. The amount of albumin in the blood serum is significantly higher ( $P < 0.05-0.001$ ) by 8.61-28.13% than in the values of the control group. In terms of the absolute content of globulin, sows exceed the animals of the control group by 0.98–3.20%. The albumin – globulin coefficient, or the so-called protein index, was by 6.17–48.15% higher. An increase in immunoglobulins of class A was also observed in the blood samples of animals (1.05 ... 1.41 times), M (1.07 ... 1.60 times) and G (1.19 times), which indicates the reduction of the antigenic load on the organism. According to these data, it is possible to speak of a more favorable state of both metabolic processes in general and the immune status of sows of the experimental groups, which had a positive effect on their fertility, the number of viable piglets, the embryonic intensity of their growth and big exterior features.

On the 28th day after farrowing, that is, during the weaning period of piglets from sows, changes in the morpho-biochemical composition of the blood caused by the effects of dietary supplements consumed with formula feed were less pronounced.

These changes in the morphological composition of the blood and biochemical composition - its serum in the gestation period and in the period of lactation reflects the increased assimilation processes and the efficiency of metabolism, manifested in a more intensive increase in live weight of these sows and their offspring.



## CONCLUSION

The results of research in the industrial complex convince that sanitation of the combined feed in the diet of sows in the period of gestation and lactation with all the studied preparations contributes to the full value of their feeding and better efficiency of the metabolic processes, which, respectively, leads to a greater reserve of nutrients during the gestation period in their bodies and at the same time provides significantly less loss of body weight for the most stressful period of lactation. It has a positive effect on the fetal and embryo growth, development and preservation of offspring. At the same time, these changes are most pronounced with the enrichment of the ration of combined feed with Provagen in combination with Coretron, the adsorbing prebiotic mineral supplement, the use of which in diets of gestated and suckling sows contributes to the improvement of natural resistance factors, as the most important bio-resource potential of sows determining the viability of litter and their level of productivity.

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