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THE USE OF VITAMIN-MINERAL PREPARATION IN THE FEEDING OF SOWS FOR REPRODUCTION LEVEL

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Abstract

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We've studied the special aspects of feeding regulation and the effect of vitamin-mineral preparation with folic acid on reproductive qualities of sows. As a result of the scientific experiment we came to conclusion that sows received an additional vitamin-mineral preparation to basic diet had a higher multiple pregnancy by 39.3% ($p < 0.05$) compared with animals of the control group. Production verification of the reproductive qualities with a larger number of animals confirmed the scientific and economic effect of using vitamin-mineral drugs. It was found that sows received the drug had a higher prolificacy (by 7.3% to 15.4%) than control animals, better preservation of piglets, high breeding efficiency.

Key words: pregnancy, chelates, vitamins, minerals, amino acids

Introduction

Essential microelements such as zinc, manganese, iron, copper and selenium are involved in a huge number of biological and physiological processes that ensure a development, productivity and animal health (Mysik et al., 2009). High productivity is achieved not only by using proteins, fats and carbohydrates but also by a sufficient supply of minerals and vitamins (Faizrakhmanov et al., 2007; Mysik, 2013). In recent time the chelate compounds of metals with the amino acids and vitamins attract a particular interest. They represent a new class of biologically active compounds, containing the substances with different chemical nature and the biological effectin its composition. When the chelate compounds of vitamins and amino acids connect with inorganic substances, their chemical and biological properties change. In many cases, biologically active substances, being a member of such compounds, display unusual in a free state biological activity. On the other hand, metal ions in combination with amino acids acquire new properties. They become less toxic and can catalyze biochemical processes (Kononenko, 2013; Perevozchicov et al., 2014).

It is interesting enough the issue of the use of some metals from the point of view of its nutritional value is considered by Arhipovsky and Deltsov (2011). They consider that it is desirable to add solid compounds of chelate metals in the premix, since uncomplexed metal ions are mixed with some anti-nutritional substances of feed, promote a rancidity of fats, destruction of vitamins A, irreversible binding of iodide ion. But the researchers also point to the existence of pairs of antagonists: zinc-copper, iron -calcium, calcium-iodine, phosphor-copper, etc. The chelation cannot help here, since chelates are not absorbed, but free ions (ligands do not let them to pass through the digestive tract), and the only outlet is considered to be a careful balancing of mineral components of the premix or „spatial separation of mutually hostile components (Jones et al., 1999; Kim et al., 2001; Golovkina et al., 2009; Arhipovsky et al., 2011; Zavalishina et al., 2011; Clos et al., 2012; Nadeev et al.,

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2012; Lavrent'ev et al., 2014). Therefore, the effectiveness of using microelements in chelate form is relevant and interesting for further study.

Materials and Methods

The economic and production tests were carried out on purebred sows of Yorkshire breed in the OOO „Kigbaevsky-becon" in the Udmurt Republic in the period from 2013 to 2015years.

For scientific and commercial expertise three groups of sows were formed according to the principle of analogues taking into account origin, age, productivity, body weight and other signs of 12 animals from each group. All animals were kept in identical conditions, according to the technology adopted at the complex. The box keeping of animals was on the principle of „empty-busy". The pig farm works on the basis of the weekly production. The complete feed stuff was used for feeding. The rate of feeding vitamin-mineral drug was 30 g per head per day. Feeding rate depended on the composition of the drug, the actual content of vitamins, minerals, amino acids in the diet and also on the physiological state of sows. The scheme of the drug application is presented in Table 1.

Methods of zootechnic accounting were used in the analysis of drug biological effectiveness in the feeding of sows. Sows' prolificacy, the weight of the dissepiments, macrocarpous, milking capacity, piglets safety, the duration of the period from weaning to insemination, breeding efficiency of sows were determined. Unproductive period after weaning was determined in days from weaning to productive insemination.

Sows' prolificacy was defined by the total number of born piglets, alive, business, dead. The weight was determined the mass of the dissepiments and macrocarpous. On the 21st day of lactation period the weighing of dissepiments was carried out to determine a milking capacity of the sow.

To estimate objectively the use of vitamin-mineral preparation with folic acid a laboratory biochemical analysis of sows' blood was carried out. Blood from 5 sows in each group was taken for analysis. Alkaline reserve of blood, the total protein, sugar, phosphorus, calcium, magnesium, iron, copper, zinc, and ketone bodies in blood were determined. Blood samples were obtained from orbital venous plexus in the morning before feeding. A larger number of sows were tested after the experiment.

According to the principle of the balanced groups, 3 groups of sows were formed – control, experimental I, experimental II and 22 heads in each group on a plot of farrowing. 6 heads of repair offspring were introduced in each group. The selection of sows for the formation of groups has been carried out on the basis of their productivity and origin and visually the condition and fatness of sows were estimated. All repair pigs, introduced in the insemination in the experimental group of sows had a positive high genetic potential based on their own productivity index and the class of their parents. All animals were housed under identical conditions. The efficiency evaluation of using vitamin-mineral preparation was carried out according to the scheme of the scientific-economic experiment. The characteristics were subjected to statistical processing with use of personal computers and Microsoft office 2003-2010 programs: Microsoft Office Excel and Microsoft office Word.

The basis of the sows diet at all stages of the physiological cycle consists of an expanded pelleted complete compound animal feeding stuff. The recipe of the fallopian animal feeding stuff fed to sows is shown in the Table 2.

Feeding of lactating sows was based on rationing during the first 7 days after farrowing and on feeding „of palatability", „ad libitum" the next period to weaning. On the day of farrowing the sows were not fed. Design of feed dispenser allows you to regulate the flow of feed individually from 0.5 kg to 4 kg of feed within one feeding. The rate of feeding after farrowing was 2 kg with a subsequent increase in rates by 0.5 kg for each piglet after one feeding. The sows were fed 4 times daily the first 3 weeks after farrowing at certain times – at 8.00 a.m, 11.00 a.m., 3.00 p.m., 7.00 p.m. One more feeding was added at 10.00 p.m. a week before weaning.

Table 1
The scheme of the drug application (30 g/animal/day)

GROUP	1 stage		2 stage		3 stage	
	Start feeding	Duration	Start feeding	Duration	Start feeding	Duration
Control	–	–	–	–	–	–
Experienced I	5 days before weaning	5	5 days after insemination	5	5days before farrowing	5
Experienced II		5	1 day after insemination	10		5

Results

We have analyzed the time from weaning till heating of the experimental and control groups. The data are presented in Table 3. The sow's of experimental groups quickly came to the hunt and were inseminated. Weaning as a powerful stressor for sows, what is accompanied by a change of the productive housing, transporting the housing to yeld sows, changing of a diet, feeding regime, temperature conditions. Investigated drug is vitamins-rich, including vitamin E and selenium which act as powerful antioxidants that reduce the effects of stress on the body.

The use of a vitamin and mineral preparation in the diets of sows had a certain impact both on quantity and quality

Table 2
Composition of complex vitamin-mineral supplement (content in 30 g)

Indicator	Number	Indicator	Number
VitaminA	201000 IU	Isoleucine	not less than 105 mg
VitaminD3	1590 IU	Alanine	not less than 66 mg
VitaminE	540 mg	Leucine	not less than 192 mg
VitaminC	162 mg	Phenylalanine	not less than 239 mg
VitaminB1	13.2 mg	Tyrosine	not less than 64 mg
VitaminB2	48 mg	Aspartic acid	not less than 72 mg
VitaminB6	28.5 mg	Glutamicacid	not less than 501 mg
VitaminB12	0.6 mg	Copper	24 mg
VitaminPP	162 mg	Iodine	1.8 mg
VitaminK3	17.7 mg	Cobalt	0.3 mg
Threonine	not less than 90 mg	Selenium	0.9 mg
Serine	not less than 288 mg	CalciumPantothenate	120 mg
Valine	not less than 132 mg	Biotin	1.7 mg
Proline	not less than 474 mg	Folic acid	45 mg
Methionine	not less than 63 mg	Choline	225 mg
Glycine	not less than 549 mg	Zinc	255 mg
Lysine	not less than 336 mg	Manganese	96 mg
Histidine	not less than 129 mg	Iron	225 mg
Histidine	not less than 78 mg	Filler	Calcium carbonate up to 1 kg

Table 3
Reproductive qualities of sows

Indicator	Groups		
	Control	Experimental I	Experimental II
	X±m	X±m	X±m
n	10	11	9
Duration of after weaning period to insemination	4.4±0.2	4.0±0.1	3.5±0.1
Quantity of live pigs in a nest, a head	11.2±1.1	12.6±0.9	15.6±1.5*
Quantity of pigs in a nest with live weight less 800 g, a head	1.0±0.15	0.91±0.20	0.83±0.14
The mass of a nest at the birth, kg	18.3±1.3	19.5±1.5	19.9±1.3
Live weight of a piglet at the birth, kg	1.46±0.07	1.32±0.12	1.16±0.12*
Quantity of pigs to weaning from a sow, a head	10.4±0.9	11.8±0.8	14.9±0.8
Safety of pigs during a suction, %	92.8	93.6	95.5
Average weaning weight 1 head, kg	8.3±0.4	8.4±0.6	8.8±0.5*
Average daily gain of pigs for the suction period, g	244±4.13	252±5.14	272±4.60*
Physiological impregnation capacity of sows, %	95	96	97
Economic impregnation capacity of sows, %	83	92	75

* - $P < 0.05$

of offspring. Multiple pregnancy in the group I increased by 12.5%, and in the group II by 39.3% at a significant difference ($P < 0.05$). The mass of a nest in the experimental groups came up to 19.5 kg and 19.9 kg that is above, than in control group by 6.6% and 8.7% respectively.

Production tests

Changes of multiple pregnancy, weight pens, and weight of pigs at birth are submitted in Table 4.

The use of a vitamin and mineral preparation in the diets of sows had a certain impact both on quantity and quality of offspring. Multiple pregnancy in the group I increased by 7.3%, and in the group II by 15.4% at a significant difference. The mass of a nest in the experimental groups came up to 16.8 kg and 17.1 kg that is above, than in control group by 7.0% and 8.9% respectively.

Live weight of one piglet at birth in the experimental group I and in the experimental group II is lower at 0.02 kg and 0.10 kg, respectively, this fact again confirms the negative correlation between multiple pregnancy and big fetus of sows. The number of newborn piglets with a live weight of less than 800g, obtained from sows of the control group was 0.95 piglets per sow, more than in the experimental groups I and II by 7.3 and 17.8% respectively at false difference. Piglets with a live weight of 800 g and below, making up the bulk of the waste sucking, demand the best quality pre-starter feed, sow' milk replacer, etc., that is they are more economically unprofitable to grow. Therefore, the less they are born, the more aligned the socket, the better will be the increase in body weight. The main efficiency indicator of sow's use is the number of its weaned piglets. With significant difference it was higher in experimental group I and group II on 0.9 and 2.2 pigs respectively in comparison with the control group. Such indicators as weaning weight of a pig, average daily gain were nearly the same and significant difference between the groups was not identified. However, during the period of suction the waste of pigs for the reasons of asphyxia (stepped on), malnutrition, etc. amounted in the control group to 6.5%, and in experienced I and II of 5.9 and 4.0 %. It also was the cause that fewer pigs were weaned from the sows in the control group, and tells us about the strength, viability of the offspring in experimental groups of sows.

Biochemical composition of blood in experimental sows

According to the results of biochemical blood analysis the following conclusions can be done. The basis of all vital processes is the metabolism of proteins. The use of vitamin-mineral complex in sows' feeding had no significant effect on protein content in the blood of animals. It should be noted that during the research a tendency to normalization of protein metabolism was revealed. At the 1 stage of the research, at the beginning of feeding, the protein content in blood corresponded to the normal values at 8 sows, and after the completion of feeding already at 9 sows. On the 2nd and 3rd stages of the research a protein level in the blood corresponded to the norm in 100% of animals. A mineral metabolism during the experiment was stabilized to a certain extent in sows of the experimental groups. In the early stage, at the beginning of feeding, drug content of calcium in the blood was below the physiological standard

Table 4

Reproductive qualities of sows

Indicator	Groups		
	Control	Experimental I	Experimental II
	X±m	X±m	X±m
n	20	26	23
Duration of after weaning period to insemination	4.6±0.2	4.0±0.1	3.2±0.1
Quantity of live pigs in a nest, a head	12.3±0.3	13.2±0.3*	14.2±0.3*
Quantity of pigs in a nest with live weight less 800 g, a head	0.95±0.23	0.88±0.22	0.78±0.18
The mass of a nest at the birth, kg	15.7±0.3	16.8±0.4	17.1±0.3*
Live weight of a piglet at the birth, kg	1.44±0.01	1.42±0.02	1.34±0.01*
Quantity of pigs to weaning from a sow, a head	11.5±0.1	12.4±0.4*	13.6±0.2*
Safety of pigs during a suction, %	93.5	94.1	96.0
Average weaning weight 1 head, kg	8.7±0.3	8.6±0.5	8.7±0.4
Average daily gain of pigs for the suction period, g	259±5.46	260±5.39	262±5.18
Physiological impregnation capacity of sows, %	92	100	92
Economic impregnation capacity of sows, %	76	100	88

* - $P < 0.05$

in 20-60% of the sows, and in the first day after feeding this ratio corresponded to the physiological norms in100% of the sows. The use of vitamin-mineral complex in the diets contributed to the normalization of protein and energy metabolism; increase the alkali reserve of the blood and the optimization of mineral metabolism with more intense involvement in the process of vitamin E.

The results of testing of the blood biochemical indicators were as follows. The biochemical blood analysis showed that using the vitamin-mineral preparation in the form of chelates promotes normalization of calcium in the blood of sows. Before baiting the calcium content in the blood didn't fit the norm in 7 animals, and after baiting only in 2 sows. The content of phosphorus in the blood was normalized. Accordingly, this led to normalization of the calcium-phosphorus ratio in the experimental animals and was within the limits of crystals of 1.3:1 to 1.5:1. An alkaline reserve is one of the indicators of the body buffer properties. Some excess of its value before the beginning of the experiment returned to normal after drug baiting. The decrease of reserve alkalinity in the first stage of blood sampling (weaning-insemination) from 64.7 rpm/%CO_2 to 56.4 rpm/%CO_2y in the experimental group I and from 72.8 to 60.5 in the group II. It resulted from after weaning sows' stress, changing the production building, transporting the animals, changing of a diet. The decrease of reserve alkalinity in the last stage of blood sampling (before farrowing – farrowing) from 64.9 on/%CO_2 to 56.1 in the experimental group I and from 62.7 to 55.1 rpm/%CO_2 in the group II is due to the strong stress during farrowing, and a concentrate type of feeding. However, in sows that received additives these jump changes of reserve alkalinity were less noticeable. The content of total protein in serum remains throughout the experience unchanged; the concentration is within the physiological norm. A slight increase of the total protein concentration immediately after farrowing in the experimental animals by 3.8-5.4% of control measurements is explained with the intensity of metabolism, milk productivity. Before the baiting the content of magnesium, iron was below the physiological norm in 3 animals and after baiting with unreliable difference it came back to normal. At the first stage of blood sampling, the concentration of vitamin E increased in sows of the experimental groups I and II, respectively by 0.32 mg% mg and 0.36% after drug baiting. The decrease in the concentration of vitamin E in the blood of the experimental animals immediately after farrowing is explained by a stressful situation for sows and more intensive involvement of vitamin E on the protective functions of the organism as antioxidant material.

We believe that our research will be associated not only with the effect of vitamin-mineral preparation on sows but also on boars, on the quality of sperm production, on the growth and development of their offspring.

Conclusions

The use of a vitamin and mineral preparation in the diets of sows had a certain impact both on quantity and quality of offspring. Multiple pregnancy in the group I increased by 12.5%, and in the group II by 39.3% at a significant difference ($P < 0.05$). Multiple pregnancy in production tests in the group I increased by 7.3%, and in the group II by 15.4% at a significant difference ($P < 0.05$).

We believe that our research will be associated not only with the effect of vitamin-mineral preparation on sows but also on boars, on the quality of sperm production, on the growth and development of their offspring. The effectiveness of using microelements in chelate form is relevant and interesting for further study.

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