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BIOTECHNOLOGICAL METHODS OF STIMULATION OF REPRODUCTIVE FUNCTION OF MAIN SOWS

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Development of new and improvement of existing biotechnological methods for activating the reproductive function of sows remains one of the current areas of scientific research, which is a necessary condition for the current revival of industrial complexes with a full cycle of pig production.

The results of experiments on studying the influence of vitamin-hormonal stimulation of older sows to extend their productive longevity are presented. The experiments were carried out in the conditions of industrial pig farming separately in the spring and summer seasons. The work was aimed at increasing the efficiency of pig farming in conditions of intensified production.

According to the results of the research, it was found that in the spring period of the year, when using vitamin and hormonal treatment, an increase in the fertility of older sows (3 years and older) is observed to 86.6 %, compared to 76.9 % in the control group. In the experimental group, 15 sows came into heat within 4−5 days, of which 13 were fertilized; in the control group, out of 15 animals, 13 animals came into heat within 8 days, of which 10 or 76.9 % of the sows were fertilized. Comparing the obtained data, it should be noted that the sows of the experimental group came into heat 3 days earlier than the control animals.

It has been proven that when vitamin and hormonal preparations are administered to the main sows older than 3 years and using natural mating, an increase in the fertility rate is observed by 9.7 %.

Such an important indicator as the multiparity of sows was higher by 4.0 % (from 13 experimental sows 34 piglets were obtained more compared to the control group of animals).

Studying the main reproductive indicators of sows in the summer season: it was found that when using vitamin-hormonal treatment, fertilization was at the level of 80 %, which is 6.7 % higher than in the control. Within 6 days, all 15 animals of the experimental group came into sexual heat, while 12 of them (80 %) became fertile after mating. The sows of the control group, which were not treated with vitamin and hormonal agents, came into sexual heat within 8 days; out of 15 animals, only 11 animals or 73.3 % were fertilized. The multiparity rate of sows in the experimental group was 8.4% higher than in the control group (10 piglets were born from 12 sows).

Keywords: *vitamin-hormonal stimulation, pigs, fertilization, multiparity*

БІОТЕХНОЛОГІЧНІ МЕТОДИ СТИМУЛЯЦІЇ РЕПРОДУКТИВНОЇ ФУНКЦІЇ ОСНОВНИХ СВИНОМАТОК

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Розробка нових та удосконалення існуючих біотехнологічних методів активізації відтворної функції свиноматок залишається одним із актуальних напрямків наукових досліджень, що є необхідною умовою при теперішньому відродженні промислових комплексів з повним циклом виробництва продукції свинарства.

Представлено результати експериментів з вивчення впливу вітамінно-гормональної стимуляції свиноматок старшого віку для подовження їх продуктивного довголіття. Досліди було здійснено в умовах промислового свинарського господарства окремо у весняну та літню пору року. Робота була спрямована на підвищення ефективності ведення свинарської галузі в умовах інтенсифікованого виробництва.

За результатами досліджень встановлено, що у весняний період року при застосуванні вітамінно-гормональної обробки спостерігається збільшення заплідненості свиноматок старшого віку (3-х років і більше) до 86,6 %, проти 76,9 % у контрольній групі. У дослідній групі прийшли в охоту 15 свиноматок протягом 4−5 діб, з яких запліднилось 13 голів; у контрольній групі з 15 голів в охоту протягом 8 діб прийшло 13 голів, із них запліднились 10 або 76,9 % свиноматок. Порівнюючи отримані дані, слід відмітити, що в охоту свиноматки дослідної групи прийшли на 3 доби раніше ніж контрольні тварини.

Доведено, що при введенні вітамінного та гормонального препаратів основним свиноматкам старше 3-х років та використанні природного парування спостерігається підвищення показника заплідненості на 9,7 %.

Такий важливий показник, як багатоплідність свиноматок, була вищою на 4,0 %, (від 13 дослідних свиноматок отримано на 34 поросят більше порівняно із контрольною групою тварин).

Вивчаючи основні репродуктивних показники свиноматок у літню пору року: встановили, що при застосування вітамінно-гормональної обробки заплідненість була на рівні 80 %, що 6,7 % вище ніж у контролі. Протягом 6 діб у статеву охоту прийшли всі 15 тварин дослідної групи, при цьому 12 із них (80 %) стали поросними після парування. Свиноматки контрольної групи, які не оброблялися вітамінними та гормональними засобами у статеву охоту прийшли протягом 8 діб; із 15 тварин запліднилось лише 11 голів або 73,3 %. Показник багатоплідності свиноматок у дослідної групи був вище на 8,4 % ніж у контролі, (від 12 свиноматок народилося на 10 поросят більше).

Ключові слова: *вітаміно-гормональная стимуляція, свині, заплідненість, багатоплідність*

Introduction. In solving the meat problem, an important place is given to pig breeding as one of the most effective branches of animal husbandry, which is due to the

biological characteristics of pigs, which are manifested in their high multiparity, early maturity and significant growth intensity. (Usenko, S. O., et al., 2020).

Intensification of the pig breeding industry should provide for the maximum use of the biological characteristics of pigs not only through the provision of progressive breeding and feeding methods, but also through the application of new biotechnological methods of stimulating the reproductive capacity of animals. (Bezverkha, L. et al., 2021; Paliy, A. P. et al., 2024).

Reproductive ability is largely determined by the morphofunctional state of the reproductive system of sows, which depends on environmental factors, the level of feeding and conditions of detention (Ulyanchenko, O. V. et al., 2015; Mykhalko, O. H., 2021; Pankeyev, S. P., 2022).

In most pig farms, the main problem is the lack of gilts available to replace old and unproductive sows. The experience of specialists indicates that the number of gilts in the herd should be regulated, depending on the goals of the strategy for repairing the breeding stock (it is advisable to replace old sows only when you have the best young gilts) (Radchenko, V. I., 2017).

One of the best indicators for herd repair is the number of farrowings. The indicators of animal productivity, in particular the number of live-born piglets in the litter, depend on them. Usually it is highest in sows of the 2nd–4th farrowing, and starting from the 5th it gradually decreases. The age of the animals and their productivity determine the terms of economic use of the breeding stock, which in turn necessitates the study of the reproductive qualities of sows. As a rule, in most pig farms, animals are culled after 3 years of intensive use, but since sows of this age still retain good indicators of multiparity and good maternal qualities, the animal is left for further use (Kharenko, M. I., Khomyn, S. P., 2010; Ivanov, V. O., Voloshchuk, V. M., 2013).

The reproductive qualities of sows depend on the state of the reproductive system and are determined by the following indicators - sexual behavior, intensity of estrus, and depend on negative factors of maintenance - stress, monotonous feeding, imbalance of nutrients according to the physiological state of sows, lack of active exercise and pastures with green fodder (Baban, O. A. et al., 2018).

The sow's body is physiologically weak after weaning piglets. To restore its reproductive function, preparations containing vitamins, amino acids and necessary trace elements are required. One of the veterinary preparations that has proven itself well is "Introvit". This is a complex preparation that contains all the necessary components for the treatment and prevention of metabolic disorders in the animal body (Veterinaryye preparaty, 2024; Pylypchuk, O. S., Sheremet, V. I., 2015).

In the technology of modern pig farming, the issue of maintaining maximum productivity and reproduction of sows over a long period of time is important. This, in turn, requires full-fledged balanced feeding, stable operation of the neurohumoral system of regulation of reproductive function and endocrine glands (Baban, O. A., 2018; Pylypchuk, O. S., Sheremet, V. I., 2014).

Scientists' studies have experimentally proven the possibility of stimulating sexual activity for planned regulation of reproduction of a herd of pigs. management of reproductive functions of females, synchronous induction of heat and ovulation in them by using various hormones and their synthetic analogues (Robert, V Knox, 2015; Drahan, P. O., Ivasenko, B. P., 2023).

To intensify the reproductive function of sows by normalizing, restoring, stimulating and synchronizing the reproductive function, a variety of methods and techniques are currently successfully used in the practice of veterinary obstetrics and reproductive biotechnology, including the use of combined hormonal preparations, which

contain two gonadotropins: mare serum (stimulates the development of follicles) and human chorionic (stimulates the onset of ovulation and the formation of the corpus luteum) (Bodnar, O. O. et al., 2010).

The relevance of vitamin-hormonal regulation of the reproductive system of pigs lies in the requirements of modern intensive technologies and economic efficiency (Humennyy O. H., Shpilevska V. V. 2015; Sukhin, V. M., et al., 2012; Andrushko, O. B., Sharan, M. M., 2010). The efficiency of reproduction can be increased by using methods of stimulating the heat of the main sows older than 3 years, to extend their productive longevity.

The purpose of the research is to study the effectiveness of individual biotechnological methods for a more complete realization of the reproductive potential of pigs.

Materials and methods of research. In previous years, vitamin-hormonal stimulation was studied in studies on replacement pigs and main sows. At the same time, several variants of stimulation schemes were tested and the most effective one was selected in terms of improving reproductive indicators (coming to heat after weaning of piglets, fertilization and multiparity). This made it possible to reduce the number of experimental groups in the current work and use the most effective variant of vitamin-hormonal treatment.

For this purpose, 2 groups of Landrace sows were formed, each with 15 heads in the group, aged 3 years and older, weighing 200−250 kg. The research was conducted in the private company "Saenko L. V." Krasnogradsky district of Kharkiv region.

In the experimental group of animals, the complex vitamin preparation "Introvit" was used in a dose of 8 ml intramuscularly to each animal 3 days before weaning the piglets and on the day of weaning the piglets, the hormonal preparation "Gestavet" was used in a dose of 5 ml intramuscularly. The control group of animals was not administered vitamin and hormonal preparations.

The farm keeps 12 Landrace boars and natural mating is used. The selection of sows in the hunt is carried out twice a day. After establishing the immobility reflex in the sows by the boar - the probe, the uterus is allowed to the boar-breeder assigned to it.

Research results. The effect of stimulation of sows older than 3 years was studied to extend their productive longevity. The reproductive indicators of sows were determined: coming into heat after weaning piglets, fertility, multiparity in the spring and summer seasons.

According to the results of research in the spring season, it was proven that when using vitamin-hormonal treatment, an increase in the fertility of sows older than 3 years is observed to 86.6 %, compared to 76.9 % in the control. 15 sows came into heat within 4−5 days, of which 13 were fertilized (experiment). Of the 15 heads, 13 heads came into heat within 8 days, of which 10 or 76.9 % of sows were fertilized (control). Comparing the data obtained, it should be noted that the sows of the experimental group came into heat 3 days earlier than the control group of animals.

According to the results of the conducted studies, it was found that when vitamin and hormonal preparations were administered to main sows older than 3 years and natural mating was used, the fertility rate increased by 9.7 % compared to the control group.

The multiplicity of sows in the experimental group was higher by 4.0 % compared to the control group of animals, sows that were administered complex preparations gave birth to 34 piglets more than in the control group.

It was also found that per inseminated sow (those that became pregnant and those that were not inseminated), the difference between the groups is 14.9 % in favor of the

experimental one, so 1.29 piglets more than in the control were obtained (P>0.999). The results of the studies are presented in the table.

Table

Reproductive ability of main sows of older age when using vitamin and hormonal treatment

Group	Animal treatment	Fertilized, head	Farrowing		Number of piglets born, head.	Fertility, (per farrowing uterus), head	Average number of piglets (per inseminated uterus) head.
			гол.	%			
Spring time							
Experiment	Vitamin-hormonal	15	13	86,6	130	10,00 ±0,20	8,67 ±0,13 ***
Control	No treatment performed	13	10	76,9	96	9,60 ±0,27	7,38 ±0,21
Summer time							
Experiment	Vitamin-hormonal	15	12	80	117	9,75 ±0,25	7,80 ±0,26 *
Control	No treatment performed	15	11	73,3	107	9,72 ±0,24	7,13 ±0,19

*Note. * P> 0.95; *** P> 0.999 - compared to the control.*

The study on sows in the summer season was carried out according to the same scheme as in the spring, using the same number of animals, 15 animals in the experimental and control groups. Natural mating of sows with boars attached to them was used.

Determining the reproductive indicators of sows: coming into heat after weaning piglets, fertility and multiparity of animals in the experimental and control groups, the following was established: when using vitamin-hormonal treatment in the experimental group, the fertility indicators were at the level of 80 % and 73.3 % in the control group. The studies revealed that in the experimental group, the fertility indicator was 6.7% higher compared to the control group. 15 animals in the experimental group came into heat within 6 days, 12 of which 80 % became fertile.

The sows of the control group, which did not receive any drugs, came into heat within 8 days, and out of 15 animals, only 11 or 73.3 % were fertilized.

In the summer, according to the results of the studies, 10 more piglets were born in the experimental group than in the control, which is 8.4 %. The multiparity index of the sows of the experimental group was 9.75 piglets, in the animals of the control group the multiparity was 9.72, that is, the index was 0.4 % lower. In terms of overall efficiency per inseminated sow (fertilized and unfertilized), a small difference of 8.6% was obtained and 0.67 piglets were obtained, with the advantage of the experimental group over the control (P> 0.95).

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Determining the influence of the season on the reproductive performance of sows, it was found that the difference in the fertilization rate between the experimental groups was 6.6 % in favor of sows that became pregnant in the spring. Between the control groups, the difference in this indicator was 3.6 %, that is, many times smaller. Determining the difference in the multiparity rate between the experimental groups, it was found that it was 2.5 % superior to the group of animals that were pregnant in the summer. In the control groups, the difference was only 1.2 %. Comparing the number of piglets born in the experimental groups, a difference of 13 heads or 10% in favor of sows that farrowed in the summer was found. The advantage of 11 piglets or 1.3 % was between the animals of the control group in favor of sows that farrowed in the summer.

Thus, it was established that the indicators of reproductive ability were better when using the vitamin-hormonal treatment scheme for sows, both in the spring and summer seasons.

Discussion. In the scientific literature, there are a number of reports on the relationship between the level of reproductive traits of sows and their age. In particular, researchers (Pokhodnya, H. S., 2011) claim that with increasing age of sows, their multiparity increases. Studies conducted by scientists (Nekrasova M. A, 2020) revealed a significant influence of the age of sows on the manifestation of their reproductive qualities. In particular, it was established that the multiparity of sows increased with increasing age. Thus, at the first farrowing, the value of this indicator was 9.9 goals. Gradually increasing with each farrowing, it reached its maximum of 11.3 goals in sows with the sixth farrowing, the difference between the first and sixth farrowings was 1.4 goals ($p<0.001$).

According to our data, it was found that when using the vitamin preparation "Introvit" and the hormonal preparation "Gestavet" in the sows of the experimental group, an increase in the fertility rate was observed compared to the control group by 9.7 % in the spring season and by 6.7 % in the summer. The indicators obtained by us are confirmed by the data of other researchers. In particular (Pylypchuk, O. S., Sheremet, V. I., 2015) feeding sows the biologically active preparation "Glutame 1M" at a dose of 20 ml for three days immediately after weaning the piglets in combination with an injection

of "Introvit" at a dose of 10 ml on the day of weaning increases their fertility by 21.4 %, multiparity by 1.6 heads and halves the number of stillborn piglets.

Many studies have proven (Drahan P. O., Ivasenko B. P., 2023, Bodnar, O. O. et al., 2010, Humennyy O. H., Shpilevska V. V., 2015) that the administration of combined hormonal preparations to sows, which contain two gonadotropins: mare serum (stimulates the development of follicles) and human chorionic (stimulates the onset of ovulation and the formation of the corpus luteum), is an effective means of restoring the sexual function of animals (Andrushko, O. B., Sharan, M. M. (2010). Scientists (Pylypchuk, O. S., Sheremet, V. I., 2014) found that the administration of a preparation containing gonadotropic hormones to stimulate sexual function in sows after weaning piglets helps to reduce the idle period and increase the fertility of animals. Our studies confirm this conclusion. Thus, in the spring season, 15 sows came into heat within 4−5 days, of which 13 animals were fertilized (experiment). In the control group, 13 animals came into heat within 8 days, of which 10 or 76.9 % of the animals were fertilized. In the summer season, 15 animals of the experimental group came into heat within 6 days, of which 12 or 80 % became pregnant. The sows of the control group, which did not receive any drugs, came into heat within 8 days, and of the 15 animals, only 11 or 73.3 % were fertilized.

The same authors (Pylypchuk, O. S., Sheremet, V. I., 2014) noted that with a sows' idle period of 4−5 days, a higher percentage of fertilization is observed, compared to its duration of 7−8 days. The same pattern was observed in our experiments.

According to (Kramarenko, S.S. et al., 2008), in most sows, the number of piglets in the litter increases to the fifth - sixth farrowing. Piglets obtained from sows in the second and sixth farrowings increase their live weight faster.

According to the studies of scientists (Leontev V.V., 2008; Topchiy L. I., 2009). Topchiy L. I., 2009) one of the problems of industrial pig farming is the influence of the season on the reproductive function of animals. This is probably due to the fact that environmental factors also change with the season of the year, among which the most important are ambient temperature, air humidity, etc.

The issue of the influence of individual factors on the indicators of reproductive characteristics of sows is widely discussed in the scientific literature. It is no coincidence that we divided the studies into spring and summer in our experiments. It was reported (Javier Piñán et al., 2021) in particular about a significant difference in fertility and multiparity indicators depending on the season of the year. It was also reported about the influence of age on the reproductive characteristics of sows. Therefore, in our studies, sows after 6 or more farrowings were taken to obtain correct results.

Studies (Mykhalko, O. H., Povod M. H., 2019) showed that the multiparity of sows in the experimental group in spring was significantly higher by 2.21 heads or 15.13% ($p<0.001$) in the experimental group compared to the control group. Scientists noted that in the summer months, despite the increasing influence of external seasonal factors, which should theoretically reduce the total number of piglets at birth, this indicator had some increase in the experimental group, in the summer the total number of piglets born was 16.07 heads, which is 3.01 heads (18.73 %) more than in the control group ($p<0.001$). The presence of a significant effect of the season of the year on the reproductive qualities of sows is confirmed by the findings (J. Hagan, 2018, Y.H. Huang, 2003).

Our studies on a group of sows have shown that the multiparity index of sows in the experimental group was 4.0% higher than that of the control group in the spring. The difference in the multiparity index of sows in the summer between the groups was 0.4 %. The effect of stimulation of sexual function in sows with a combination of gonadotropins

and vitamins on multiparity indices has also been noted by other scientists (Sukhin, V. M., Chumak, V. O., Kryva, O. A., 2012).

Our experiments have shown a positive effect on sows over 3 years of age not only by the injection of "Introvit" and "Gestavet", but also by the use of natural mating with boars with proven reproductive function. In our opinion, this additionally increased the fertility and multiple birth rates in the older age group of animals.

Conclusions. Based on the results obtained, a scheme for vitamin and hormonal stimulation of the reproductive function of sows is proposed.

It was found that when vitamin and hormonal preparations were administered to sows in the experimental group and natural mating was used, the fertility rate increased compared to the control group by 9.7 % in the spring and by 6.7 % in the summer.

It was studied that the multiple birth rate in sows in the experimental group in the spring period was higher when using the complex preparation "Introvit" and the hormonal preparation "Gestavet" by 4.0 % compared to the control. The difference in the multiparity index of sows in the summer season between the groups was 0.4 %.

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