ADAPTABILITY AND REPRODUCTIVE QUALITIES OF SOWS AND INDICATORS OF THEIR BLOOD BY KEEPING IN MACHINES WITH ADVANCED ELEMENTS

The period of pregnancy and farrowing of sows and their maintenance with suckling piglets is one of the key stages of industrial pig breeding, as it is proved that productive and reproductive qualities of pigs are largely determined by the intensity of growth and development in the early stages of their lives. To solve these problems, it is extremely important both in theoretical and practical terms to study the adaptive and reproductive ability of sows and the safety of piglets by their keeping in machines with advanced elements and machines of mass production.

It is known that a pregnant sow stays in the machine for 3–5 days before farrowing, and after 21–35 days and more, which necessitates the improvement of conditions for their keeping. After monitoring the existing equipment for farrowing and keeping suckling sows, it was found that the improvement of individual elements of the machines can significantly optimize the physiological and hygienic conditions of their maintenance and increase the comfort for newborn piglets. Therefore, we have proposed a device for the removable side wall of the machine to increase the space for the sow’s exercise, as well as to activate her game behavior with the offspring. The device consists of the following main parts: the upper and lower fastenings of the side wall to the base of the machine, as well as two S-shaped structures made of stainless steel with a diameter of 6 mm. Using the device is possible in two ways.

For optimal access of piglets to the sow’s nipples, it is proposed to increase the floor at the place where the sow is by 1-3 cm. Raising the space under the sow provides piglets with better access to the lower row of nipples, so that they are freely located around the sow. And since the place is raised directly only under the sow, piglets can freely move around the "mother's" front and back. The lifting structure is made from hard-alloy plastic or hard rubber 2 cm thick, 60 cm wide and 80-120 cm long. It is fastened to the machine base using self-tapping screws if the base is plastic or expansion bolts, if the base is made from grating concrete.

Based on the selected individual structural elements of the machines for lactating sows, the improvement of which optimally ensures their biological characteristics of keeping, an experimental model of the machine for keeping lactating sows and piglets was made.
Assessment of the adaptive and reproductive ability of sows and the study of the cellular component of natural immunity was carried out based on the results of farrowing in the spring and summer. It was found that keeping sows with offspring in machines with advanced elements increases their adaptability by the index of breeding value (CPI) by 39.0 points (8.1 %), the index of adaptation (IA) by 1.2 points (4.7 %). In sows kept in machines with advanced elements compared to animals in series-produced machines, milk yield was higher by 4.9 kg (7.3 %), live weight of the nest at weaning – by 7.9 kg (9.8 %, P <0.05), and the safety of piglets by 1.0 %. At the same time, the number of leukocytes, phagocytic activity of neutrophils, phagocytic index and phagocytic number in these sows increased by 1.9, 1.4, 2.9 and 4.8% respectively.

Key words: pigs, technology of keeping, machine equipment, adaptation, reproductive ability, cellular component of natural immunity.
пересуватися повз неї спереду і ззаду. Конструкцію підвищення виготовлено з твердосплавного пластiku або твердої гуми товщиною 2 см, шириною 60 см та довжиною 80–120 см. Кріплення її до основи станка здійснюють за допомогою самонарізів (шурупів), якщо основа пластикова, або розширюючих болтів, якщо основа з решітчастого бетону.

На основі відібраних окремих елементів конструкції станків для утримання підсисних свиноматок з поросятами, вдосконалення яких оптимально забезпечує біологічні особливості їх утримання, було виготовлено експериментальний зразок станка.

Оцінку адаптаційної та репродуктивної здатності свиноматок та дослідження клітинної ланки природного імунітету проведено за результатами отриманих опоросів у весняно-літній період. Встановлено, що утримання свиноматок з приплюдом у станках з удосконаленими елементами підвищує їх адаптаційну здатність на 39,0 бала (8,1 %), індексом адаптації (IA) – на 1,2 бала (4,7 %). У свиноматок, які втримували у станках з удосконаленими елементами, порівняно з тваринами, які знаходилися в станках серійного виробництва, молочність була вищою на 4,9 кг (7,3 %), жива маса гнізда при відлученні – на 7,9 кг (9,8 %, Р<0,05), а збереженість поросят – на 1,0 %. Водночас у вказаних свиноматок кількість лейкоцитів, фагоцитарна активність нейтрофілів, фагоцитарний індекс і фагоцитарне число більше відповідно на 1,9; 1,4; 2,9 і 4,8 %.

Ключові слова: свині, технологія утримання, станкове обладнання, адаптація, репродуктивна здатність, клітинна ланка природного імунітету.

Introduction. Methods of intensive rearing of pigs in the conditions of farms of different types with the use of industrial technology do not allow to fully use the potential productive and reproductive capabilities of the pigs. Crowding, confinement, noise and other factors adversely affect the adaptability and health of pigs [1, 5, 9, 14, 15]. In this regard, the production of competitive pork is possible only if the development and implementation of technological solutions to create comfortable conditions for suckling sows to ensure their high adaptability, reproductive function and safety of piglets. Therefore, the period of pregnancy and farrowing of sows and their maintenance with suckling piglets is one of the key stages of industrial pig breeding, as it is proved that productive and reproductive qualities of pigs are largely determined by the intensity of growth and development in the early stages of their lives [4, 7, 16, 18, 23]. It is proved that the main feature of the body of piglets is the ontogenetic immaturity of tissues, digestive organs and the functions of the thermoregulatory mechanism. Therefore, they are particularly sensitive to environmental factors. Any deviation from the norm immediately leads to a decrease in the
body's natural resistance, and thus to a decrease in growth rate and even death of piglets [3, 4, 6, 12, 16, 20, 23].

In this regard, one of the ways to increase the efficiency of the pig industry is the development and implementation of new technologies for keeping pigs aimed at improving machine equipment for suckling sows and technologies for their maintenance [11, 19, 26, 29, 38, 39]. The arrangement of the farrowing place is an important stage in industrial pig breeding, as the main indicators of high reproductive capacity of sows (fertility, milk yield and safety of piglets) depend on the conditions of their maintenance [2, 29, 30, 31, 33, 36, 37]. That is why when developing machines for suckling sows, special attention is paid to their type and shape, as well as the structure of the floor and the material from which it is made [20, 25, 27, 32, 35]. That is, the main task is to equip the place of farrowing with equipment that will provide optimal conditions for sows during farrowing and in the postpartum period and comfort of piglets in the first days of life [17, 21, 22, 24, 34].

Over the past years [10, 13], we conducted a series of studies to improve machine equipment for suckling sows and piglets, in particular, identified some elements that optimally provide the biological characteristics of pig keeping. After analyzing the monitoring data of existing types of machines for farrowing and keeping suckling sows, we found that the improvement of individual elements of machines can significantly optimize the physiological and hygienic conditions of their maintenance, increase the free movement of sows, significantly reducing hypodynamics without reducing the area and comfortable conditions for piglets and suckling piglets. In the revised machines of domestic and foreign production, the place under the sow has a flat surface, regardless of the material from which it is made. However, based on our own observations and experience of the staff of complexes and pig farms, we found that when an adult sow lies on a flat surface for feeding piglets, she often undermines the lower row of teats, making it difficult for piglets to access them, especially in the first 5-7 days after birth. Raising the space under the sow gives the piglets better access to the teats so that they are freely placed around it. And because the place is raised directly just below the sow, the piglets can move freely past it in front and behind.

Raising the place under the sow is carried out by installing plates of plastic or hard rubber 2–3 cm thick, 80 cm long and 60 cm wide and attaching them to the base of the machine with self-tapping screws if the floor is plastic slotted, or expansion bolts if the base made of lattice
concrete, which allows free access of piglets to the bottom row of sows' nipples during feeding.  

Due to the fact that a pregnant sow is in the machine before farrowing 3–5 days, after – 21–35 days or more (according to preliminary calculations 40–45 days before weaning piglets), there is a need to improve the conditions of its keeping, namely to ensure the possibility of free movement in the area of cell placement. Therefore, we offer a device for the removable side wall of the machine to increase the space for the sow's exercise, as well as to activate her game behavior with the offspring.  

The device consists of the following main parts: the upper and lower attachment of the side wall to the base of the machine, as well as two S-shaped structures made of stainless metal with a diameter of 6 mm. To further strengthen the attachment of the removable side wall using expansion bolts, self-tightening nylon clamps and a design in the form of a pin for attaching the front of the removable wall to the wall.  

The device can be used in two ways: with limited mobility of sows in the first days after farrowing and with increase in the free area for moving in the machine 3–5 days after farrowing.  

Summarizing the literature, we can conclude that housing conditions, age and other factors affect the adaptive and reproductive capacity of sows and their offspring, and natural resistance is closely related to the viability and functional state of their body.  

Therefore, the aim of our work was to investigate the adaptability and reproductive qualities of sows and some indicators of the natural resistance of their body when kept in machines with advanced elements.  

**Materials and methods.** The methodological basis of scientific and practical research in this area is modern domestic and world achievements in the technology of keeping sows.  

Experimental studies were conducted on farm "Eden" Zhovkva district of Lviv region on sows of large white breed, 3 heads in each, selected on the principle of analogues by age, live weight and date of mating. Assessment of the adaptive and reproductive ability of sows and the study of the cellular component of natural immunity was carried out based on the results of farrowing in the spring and summer.  

Machines with improved elements (raising the place where the sow is located by 2 cm and the device of the removable side wall of the machine) were prepared for the experimental group. The control group of animals was kept in mass production machines.
The adaptability of sows was determined by indicators of reproductive qualities by calculating indices of breeding value, adaptation, level of adaptation according to the method of V. S. Smirnov [16].

Reproductive qualities of sows were determined by indicators of fertility, milk yield, live weight of piglets and nest weight at weaning, preservation of the offspring.

In heparin-stabilized blood of sows, the following was determined: the number of leukocytes – by counting white blood cells in Goriaev's chamber (V. E. Chumachenko, 1991); phagocytic activity (FA) of neutrophils (Gostev V. S., 1950), phagocytic index and phagocytic number [8].

The obtained digital material was processed by the method of variation statistics using Student's criterion. Arithmetic mean values (M) and their errors (± m) were calculated. The computer program MS Excel was used for calculations.

**Results and discussion.** Data on the reproductive capacity of experimental sows are presented in Table 1.

1. **Reproductive ability of sows when kept in machines with advanced elements and machines of serial production** (M ± m, n = 3)

<table>
<thead>
<tr>
<th>Performance indicators</th>
<th>Group of animals</th>
</tr>
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<tbody>
<tr>
<td></td>
<td>control</td>
</tr>
<tr>
<td>Fertility, heads</td>
<td>12,1 ± 0,50</td>
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<tr>
<td>number of piglets at weaning, kg</td>
<td>10,9 ± 0,78</td>
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<tr>
<td>Milk yield, kg</td>
<td>66,9 ± 1,76</td>
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<tr>
<td>Live weight of the nest at weaning, kg</td>
<td>80,7 ± 2,12</td>
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<tr>
<td>Preservation, %</td>
<td>90,1</td>
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Note. * P < 0,05.

The obtained data show that in sows of the experimental group compared to the control, milk yield was higher by 4.9 kg (7.3%), live weight of the nest at weaning – higher by 7.9 kg (9.8%, P <0,05 ), and the preservation of piglets in the experimental group increased by 1.0% compared to control.

2. **Indicators of adaptability of sows kept in machines with advanced elements and machines of serial production**

<table>
<thead>
<tr>
<th>Performance indicators</th>
<th>Group of animals</th>
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<tbody>
<tr>
<td></td>
<td>control</td>
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</table>
Breeding Value Index (CPI) | 479,1 ± 20,92 | 518,1 ± 23,17  
Adaptation index (IA) | 25,4 ± 2,89 | 26,6 ± 3,17  
level of adaptation (PA) | 13,1 ± 0,56 | 13,3 ± 0,63  

The obtained results of adaptability show that in the sows of the experimental groups compared to the control in the spring-summer period, the index of breeding value (CPI) is higher by 39.0 points (8.1%), the index of adaptation (IA) – by 1.2 points 4.7%), but the difference is unlikely. In the summer-autumn period, the difference between these indicators is similar but less pronounced and is respectively 14.9 points (2.9%) and 0.8 points (3.1%). At the same time, the level of adaptation (PA) in the spring-summer period in the animals of the experimental group compared to the control is almost the same (13.3 vs. 13.1 points), and in the summer-autumn period higher by 0.7 points (5.5%).

Based on the formula used to calculate the breeding value index (CPI), the difference between the experimental and control groups of animals is mainly due to the milk yield of sows and live weight of the nest at 2 months.

3. Indicators of the cellular component of the natural immunity of the body of experimental sows

<table>
<thead>
<tr>
<th>Performance indicators</th>
<th>Group of animals</th>
<th></th>
</tr>
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<tbody>
<tr>
<td></td>
<td>control</td>
<td>experiment</td>
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<tr>
<td>Leukocytes, G/l</td>
<td>10,8 ± 0,24</td>
<td>11,0 ± 0,33</td>
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<tr>
<td>Phagocytic activity of neutrophils, %</td>
<td>50,7 ± 3,48</td>
<td>51,4 ± 2,86</td>
</tr>
<tr>
<td>Phagocytic index, units</td>
<td>10,3 ± 0,86</td>
<td>10,6 ± 0,73</td>
</tr>
<tr>
<td>Phagocytic number, units</td>
<td>5,21 ± 0,62</td>
<td>5,46 ± 0,54</td>
</tr>
</tbody>
</table>

In sows kept in machines with advanced elements, compared with animals in machines of mass production, the number of leukocytes, phagocytic activity of neutrophils, phagocytic index and phagocytic number was higher by 1.9, 1.4, 2.9 and 4.8%, but the difference is unlikely.

**Conclusions**

1. Adaptability in sows of experimental groups, compared with control, is higher according to the index of breeding value (CPI) by 39.0 points (8.1%), the index of adaptation (IA) – by 1.2 points (4.7%).

2. In sows of the experimental group, compared with the control, milk yield was higher by 4.9 kg (7.3%), live weight of the nest at weaning – by 7.9 kg (9.8%, P <0,05), and the survival of piglets – by 1.0%.
3. In sows kept in machines with advanced elements compared to animals in mass-produced machines, the number of leukocytes, phagocytic activity of neutrophils, phagocytic index and phagocytic number was higher by 1.9, 1.4, 2.9 and 4.8% respectively.

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