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EFFICIENCY OF USING FARROWING CRATES EQUIPPED WITH AN ELECTRONIC FEEDER FOR LACTATING SOWS

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The study was conducted in 2024 at the breeding reproducer of the Cherkasy Research Station of the Institute of Agriculture of the National Academy of Agrarian Sciences on lactating Large White sows. The aim was to investigate the efficiency of using farrowing crates equipped with an electronic feeder for housing lactating sows with piglets. The farrowing crate equipment for lactating sows was modernized, and their behavior and productivity parameters were studied. The distinctive feature of the modernization was that the crate-unit was equipped with a round feeder connected to an electronic feeding apparatus, and a play device was mounted on the adjacent partition. To determine the efficiency of the experimental equipment, a control group of lactating sows (n=8) was formed in one of the farm's facilities; these sows were housed in crates with stationary farrowing crates. In the experimental group, lactating sows (n=8) were kept in experimental crates equipped with a transformable farrowing crate. Compound feed for the control group sows was delivered into standard feeders from a mechanical dispenser twice a day. Compound feed for the experimental group sows was delivered into the experimental feeders from an electronic feeding apparatus eight times a day. It was established that the improved farrowing crate equipment prevents feed wastage and improves animal welfare and productivity. The experimental group sows kept in the modernized crates outperformed their control counterparts in terms of estimated milk yield, average piglet weight, litter weight, and reproductive performance coefficient by 1.88%, 5.39%, 7.36%, and 3.17%, respectively.

Keywords: modernization, crates, electronic feeding, lactating sows, suckling piglets, behavior, live weight, reproductive traits.

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ЕФЕКТИВНІСТЬ ВИКОРИСТАННЯ СТАНКОВОГО ОБЛАДНАННЯ ДЛЯ УТРИМАННЯ ПІДСИСНИХ СВИНОМАТОК, ОБЛАДНАНОГО ЕЛЕКТРОННОЮ ГОДІВНИЦЕЮ

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Дослідження проводили у 2024 році в умовах племрепродуктора Черкаської дослідної станції Інституту землеробства НААН на підсисних свиноматок великої білої породи. Мета - дослідити ефективність застосування станкового обладнання для утримання підсисних свиноматок з поросятами, обладнаного електронною годівницею. Проведена модернізація станкового обладнання для утримання підсисних свиноматок і досліджено показники їх поведінки і продуктивності. Особливість модернізації полягала в тому, що блок-станок обладнаний круглою годівницею, до якої підведено електронний кормовий апарат, а на суміжній перегородці вмонтовано ігровий пристрій. Для визначення ефективності застосування експериментального обладнання, в одному із приміщень господарства сформували контрольну групу (n=8) підсисних свиноматок, які утримувалися в станках із стаціонарними фіксуючими боксами. У дослідній групі підсисні свиноматки (n=8) утримувалися в експериментальних станках, що мали фіксуючий бокс придатний до трансформування. Комбікорм для свиноматок контрольної групи поступав у стандартні годівниці із механічного дозатора два рази на добу. Комбікорм для свиноматок дослідної групи поступав у експериментальні годівниці із електронного кормового апарату вісім разів на добу. Встановлено, що удосконалене станкове обладнання для опоросу запобігає траті корму, покращує добробут, продуктивність тварин. Свиноматки дослідної групи, які утримувалися у модернізованих станках за умовною молочністю, середньою масою поросяти, масою гнізда і за коефіцієнтом відтворювальних якостей переважали контрольних аналогів відповідно на 1,88: 5,39: 7,36 і 3,17 %.

Ключові слова: модернізація, станки, електронна годівля, підсисні свиноматки, поросята-сисуни, поведінка, жива маса, відтворювальні ознаки.

Introduction. Analysis of domestic and foreign literature indicates that technological equipment significantly influences animal welfare. Specifically, long-term confined housing of lactating sows negatively affects their health and reduces productivity (Baxter E.M., Lawrence A.B., Edwards S.A. et al., 2012; Lohmeier R.Y., Gimberg-Henrici C.G.E., Burfeind O. et al., 2019; Gomez J., Stigar A.-H., Boumans I.-J.-M. et al., 2021; Cheon S. N., Jeong S. H., Yoo G. Z. et al., 2022). Consequently, the

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European Union countries have adopted new welfare regulations for housing sows, which involve a transition away from confinement in crates (Glencorse D, Plush K, Hazel S. et al., 2019). To prevent hypodynamia in sows, it is recommended to confine them in crates one week before farrowing and one week after it (Mykhalko O.H., Povod M.H., 2019; Ivanov V.O., Voloshchuk V.M., 2019; Zasukha L.V., 2022; Hlukhenkyi S.L., Lykhach V.Ya., 2025). For this purpose, 5–7 days after farrowing, the partitions of the farrowing crate are retracted to the side walls, which significantly increases the area available for their free movements. In this regard, further modernization of crates to improve animal welfare warrants thorough attention. To meet the nutritional requirements of lactating sows, crates are equipped with feeders featuring either mechanical or electronic dispensers. The latter method has relatively recently begun to be implemented in large-scale complexes oriented toward high productivity, enabling the maximum realization of the animals' genetic potential through feed ration optimization. However, this requires substantial investments and highly qualified personnel capable of operating complex software and electronics.

Considering the above, it is relevant to examine in detail a new system of housing and electronic feeding for lactating sows in farrowing crates. A group of specialists conducted comparative studies of different feeding systems: manual versus mechanized feed distribution. It was established that sows in crates equipped with an electronic system utilized feed nutrients more efficiently without additional loss of live weight. Furthermore, these feeders promoted a longer feed consumption time, which, according to the authors, helped satisfy the ethological need of sows to forage for food (Gorr C. S., Lieb C., Zollich W. et al., 2024). A number of publications emphasize that utilizing automatic feeding stations for lactating sows with piglets is a high-tech solution gaining popularity in modern pig farming. This avoids manual feed dosing and implements the principle of individual feeding, which contributes to compound feed savings and ensures the sustainable development of the industry (Aparicio-Arnay M., 2025). Moreover, the use of electronic feeders in crates for lactating sows allows for real-time data collection on feed intake, providing a better understanding of animal needs and behavior (Morales J., Rodríguez M. et al., 2019). The Institute of Pig Breeding and AIP of the NAAS has developed an original crate-unit for housing lactating sows, which features a farrowing crate, feeders, automatic drinkers, and infrared heating lamps. The unique feature of this crate is that one of the walls of the farrowing crate can, if necessary, transform in both horizontal and vertical planes. A drawback of this crate is that it is not equipped with electronic feeding systems.

The purpose of the study is to investigate the efficiency of using farrowing crate equipped with an electronic feeder for housing lactating sows.

Materials and Methods of Research. To accomplish the set objective, research was conducted in three stages at the breeding reproducer of the Cherkasy Research Station of the Institute of Agriculture of the NAAS. At the first stage, equipment for the electronic sow feeding system and a device for piglet play activity were developed. The distinctive feature of the modernization was that the crate-unit was equipped with a round feeder divided into four isolated segments, each connected to an electronic feeding apparatus. Additionally, a play device was mounted on the adjacent partition in the form of a four-blade wheel that rotates easily around its axis and emits sounds due to balls inserted inside the device's drum. The computer-controlled individual sow feeding system in farrowing crates consists of a volumetric dispenser and a feed dosing unit. It ensures the transportation and dosing of dry feeds of various physical forms. At the second stage, the efficiency of the innovative development was studied during the housing of lactating sows and suckling piglets. At the third stage, the efficiency of using electronic feeding

apparatuses when feeding sows was investigated. To determine the efficiency of the experimental equipment, a control group of lactating sows (n=8) was formed in one of the farm's facilities; these sows were housed in crates with stationary farrowing stalls. In the experimental group, lactating sows (n=8) were kept in experimental crates equipped with a transformable farrowing stall. Compound feed for the control group sows was delivered into standard feeders from a mechanical dispenser twice a day. Compound feed for the experimental group sows was delivered into the experimental feeders from an electronic feeding apparatus eight times a day. The feeding allowance for the sows was identical and amounted to 5.0, 6.5, 7.0, and 7.5 kg in the first, second, third, and fourth weeks, respectively. Feed wastage from the sow feeders was recorded daily. The study was conducted according to methodological recommendations[iii]. A comprehensive assessment of reproductive traits was determined using the Index of Reproductive Qualities (IRQ).

$$IRQ = 1.1 \times Ls + 0.3 \times Em + 3.3 \times Npw + 0.35 \times W \quad (1)$$

where, Ls – number of piglets born alive (litter size), heads;
Em – estimated milk yield, kg;
Npw – number of piglets at weaning, heads;
W – litter weight at weaning, kg.

Research Results. The computer-controlled individual sow feeding system in farrowing crates consists of a volumetric dispenser and a dosing unit. It ensures the transportation and dosing of dry feeds of various physical forms.

The individual feeding schedule assigned to each sow provides uniform ration consumption throughout the day, which positively affects digestion and milk secretion in the animals.

Fig. 1 shows a general view of the crate during sow confinement. Fig. 2 – the machine after the sow is released, general view; Fig. 3 – a device for stimulating the play activity of piglets in the oxonometrical plane; Fig. 4 – a section of the devic.

The crate contains: enclosure 1, gates 2 and 19, slatted floor 3 and 15, farrowing stall 4 and 14, stall partitions 5 and 6, anti-crush bars (stoppers) 12 and 13, locks 7 and 18 for the stall partitions, a piglet nest box 8, toys 9 and 20, adjacent partition 21, a round feeder 22 divided into four segments, nozzles of the electronic feeder 23, and automatic nipple drinkers for sows 24.

The crate operates as follows. A few days before farrowing, the sow is driven into the crate through gate 2. The unconfined sow moves freely within the crate, using the feeder 23 and the nipple drinker 24.

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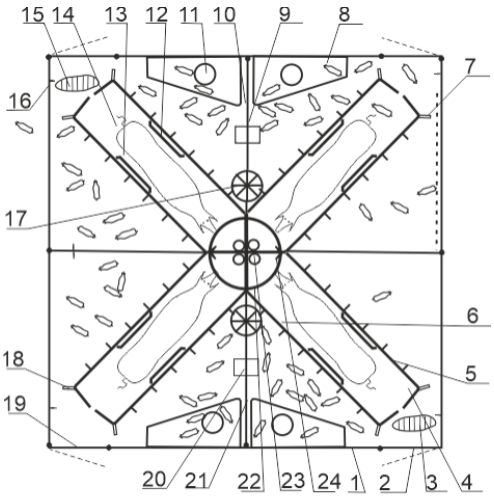

Fig. 1. **General diagram of the crate-unit in the confined state of the sow**

As farrowing approaches, the side walls 5 and 6 are rotated, forming a farrowing stall 4, in which the sow remains until the piglets develop a ‘guarding reflex’ and are protected from being crushed by the sow. This protection is also facilitated by the anti-crush bars 12 and 13.

The computer-controlled individual sow feeding system in farrowing crates consists of a volumetric dispenser and a feed dosing unit. It ensures the transportation and dosing of dry feeds of various physical forms. An individual feeding schedule assigned to each sow provides uniform ration consumption throughout the day, which positively affects digestion and milk secretion in the animals.

When a sow approaches the feeder, a reader identifies the animal and checks the feeding schedule and allowance. An individual portion of feed is dispensed into the feeder, which is consumed until the trough is clean. The sow consumes the required portion of compound feed delivered by the electronic automated machine.

5–7 days after farrowing, the sow is released from confinement, and the side walls 6 and 18 are moved to a vertical position (Figs. 2, 3) to increase the area available for exercise.

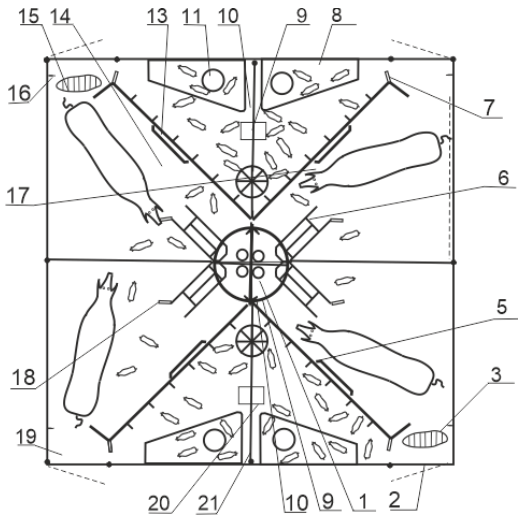

Fig. 2. **General diagram of the crate when the sow is unconfined.**

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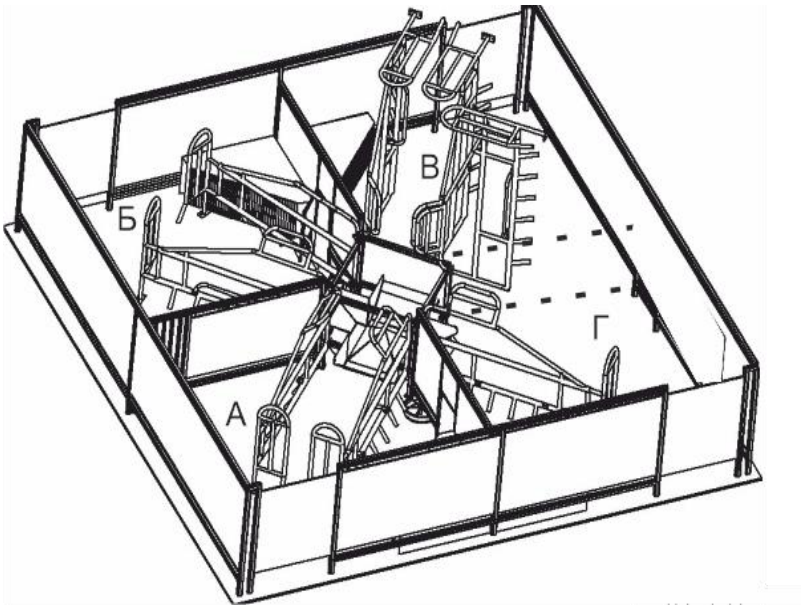

Fig. 3. **Axonometric projection of the crate: A – confined state; B, C, D – unconfined state.**

To support the life activities of the piglets, the crate is equipped with an automatic nipple drinker 18, a piglet feeder 17, an infrared heater 11, as well as a play device 9 and 20 (Fig. 4).

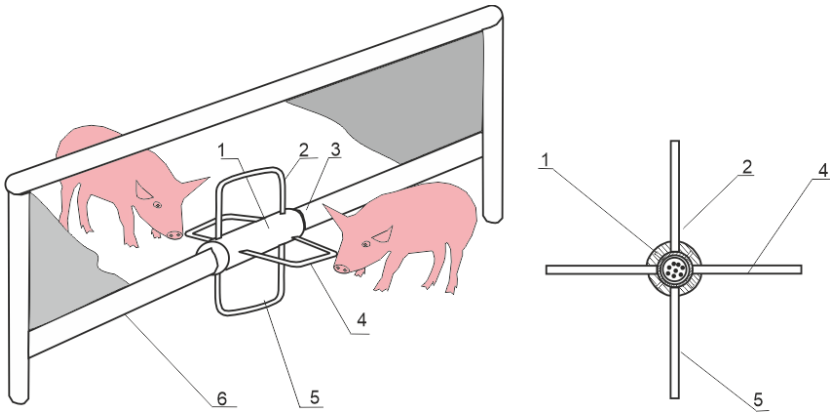

Fig. 4. **Toy for piglets: 1 – hollow drum; 2, 4, 5 – arcuate brackets; 3 – enclosure tube 7.**

The piglets' interest in the toy is also stimulated by sounds produced by the impact of metal balls located inside the hollow arcuate brackets. The piglets approach device 9 and 20 and willingly play with it. To enhance play activity, it is advisable to spray the arcuate brackets with an odorous solution. It was established that play activity increases with age. On the 7th, 14th, 21st, and 28th days of life, the average number of games per individual was 1.9, 2.5, 2.9, and 3.4, respectively. In the control counterparts, the number of games per individual was 1.5, 2.1, 2.5, and 2.9, respectively. Piglets in the experimental group outperformed their control group counterparts in locomotor activity throughout the suckling period (Fig. 5).

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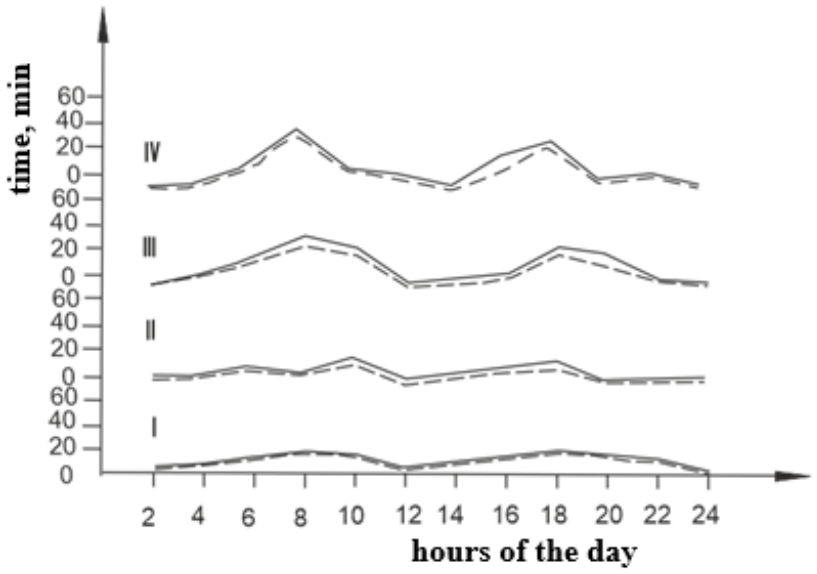

Fig. 5. **Dynamics of piglet locomotor activity during the suckling period: I, II, III, IV weeks.**

The results of piglet rearing are presented in Table 1. As can be seen from the data in Table 1, the experimental group sows outperformed their control counterparts in estimated milk yield, average piglet weight, litter weight, and reproductive performance coefficient by 1.88%, 5.39%, 7.36%, and 3.17%, respectively.

Table 1.

Productivity of Sows and Suckling Piglets

Parameter	Group	
	Control	Experimental
Number of sows, heads	8	8
Number of live piglets per sow, heads	14	14
Number of live piglets placed on the trial, total heads	112	112
Estimated milk yield, kg	56.14±0.25	57. 20±0.31*
Number of piglets at 28 days of age, per sow, heads	10.8	11.0
Average piglet weight, kg	7.41±0.06	7.81±0.08**
Average litter weight at 28 days, kg	80.02±0.82	85.91±0.95***
Piglet survival rate, %	91.07	93.75
Index of Reproductive Qualities (IRQ) of the sow	95.88	98.92

*Note: *p ≤ 0.05, **p ≤ 0.01, ***p ≤ 0.001 relative to the data obtained in the control group.*

Observations of the feeding behavior of lactating sows showed that in the experimental group crates, electronic feeders dispense feed in small portions 8 times a day, compared to 2 times a day with manual feeding. Under this scheme, the experimental group sows consume feed until the trough is completely clean, resulting in virtually zero feed wastage. In contrast, in the control group crates, feed rooting and spilling from the feeder by the sow's snout was constantly observed (ranging from 0.31 to 0.62 kg per day). Consequently, feed losses in the control group during the lactation period amounted to 5.26 kg per head.

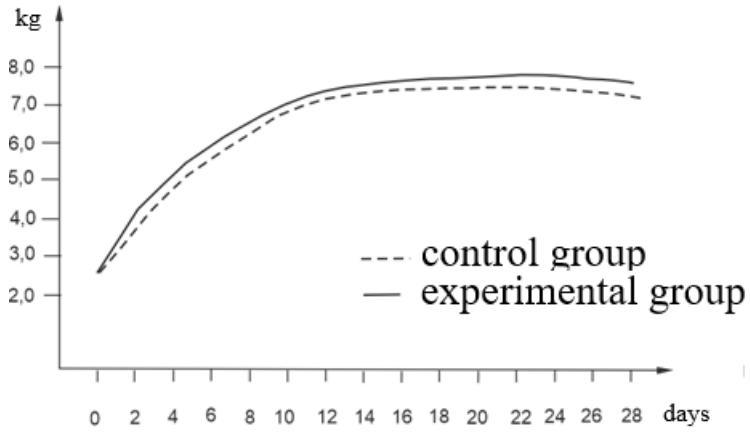

Fig. 6. **Graph of actual compound feed consumption by sows during lactation.**

The data in Figure 6 indicate that while the feeding allowance was identical, the control group sows experienced feed losses, which consequently reduced their productivity.

Discussion. Based on the analysis of modern studies in the field of pig farming, the objective was set to develop farrowing crate equipment for housing lactating sows with piglets, equipped with an electronic feeder, in order to determine its feasibility and efficiency.

Due to the modification of the crate equipment, better conditions were created for the play and locomotor activity of the experimental group piglets, as well as for the exercise of the sows. The data indicate that as the piglets age, their activity increases and is characterized by certain variability. The play device installed on the adjacent partition attracted piglets from two neighboring litters. As a result of their interaction, play situations emerged that developed into play locomotions (running, jumping, pushing) throughout the entire nesting area. The games can be individual or collective, and the piglets primarily play with partners of approximately the same live weight. Occasionally, play escalates into fighting. Of particular interest in piglet play is the ‘mounting’ behavior (jumping on one another, mock mounting). This behavior is first observed in piglets at 14 days of age. According to foreign authors, participation in locomotor and social play reduces stress and minimizes aggression, whereas the absence of play often signals poor welfare (Brown S.M., Peters R., Nevison I.M. et al., 2018; Brown S.M., Klaffenböck M., Nevison I.M. et al., 2018; Steinerová K., Krause A., Parker S. E., 2025).

It is well known that lactation is one of the most critical physiological processes in a sow, upon which the success of piglet rearing depends. Therefore, during lactation, it is crucial to monitor feed intake, as the sow's energy requirements, necessary both for her health and for the growth and development of the piglets, consistently increase. In this regard, the implementation of precision sow feeding via electronic feeding systems allows for effective control over this process. Precision feeding makes it possible to provide each animal with an optimal amount of nutrients at the right time throughout the entire lactation period (Aparicio-Arnay M., 2025; Gauthier R., Largouët C., Bussières D. et al., 2022). In the course of investigating the electronic feeding system, more economical feed consumption was observed in the experimental group sows compared to the control group. The portioned dispensing of small amounts of feed to the experimental group sows was consumed rapidly (within 2.5 minutes). Observations showed that the experimental group sows ate their feed until the trough was clean. Sows in the control group consumed their single feed allowance over 12–20 minutes and periodically rooted

feed out of the feeder with their snouts (from 0.31 to 0.62 kg per day). Occasionally, the compound feed became overly wet when the sows consumed water from the nipple drinker, a phenomenon that was not observed in the feeders of the experimental group. As a result, feed losses in the control group during the lactation period amounted to 5.26 kg per head. In our view, feed losses depend not only on the sow's behavior but also on the structural features of the feeder. Studies have shown better results when using the Gestal Solo feeder compared to the Actual feeder (Lefebvre A., 1999; Nichols, G. E., Gourley, K. M., DeRouchey J., 2017).

The conducted studies revealed several advantages of using an electronic feeding system during the suckling period. First, the system allows setting an individual feeding curve for each sow depending on the litter size, body condition, and appetite. Feeding can occur in small portions but frequently (multiple times per day). Secondly, the feed supplied is always fresh. The sow receives feed on demand. The feed does not sit in the trough for hours and does not spoil, which is particularly important under conditions of elevated temperature in the nesting area, resulting in feed savings. Thirdly, the sow consumes her feed quietly without being distracted by or warding off the piglets. Fourthly, the system records the actual feed intake of each sow, allowing for the timely detection of health issues (feed refusal is the primary indicator of illness). Fifthly, it reduces the working time of the personnel, as the operator is no longer required to clean the pen of feed residues daily.

Thus, the complex of proposed measures demonstrated that the experimental group sows kept in the modernized crates outperformed their control counterparts in estimated milk yield, average piglet weight, litter weight, and reproductive performance coefficient by 1.88%, 5.39%, 7.36%, and 3.17%, respectively. The obtained data justify the introduction of precision feeding for lactating sows through the application of an electronic feeding system.

Conclusions and Prospects for Further Research:

1. The farrowing crate equipment has been modernized by installing an electronic sow feeding system, which prevents feed wastage and improves animal welfare and productivity.
2. The experimental group sows kept in the modernized crates outperformed their control counterparts in estimated milk yield, average piglet weight, litter weight, and reproductive performance coefficient by 1.88%, 5.39%, 7.36%, and 3.17%, respectively.
3. The prospect of further research into this new method of housing and feeding lactating sows will be aimed at studying the physiological and biochemical status of the animals.

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