

ОШ МАМЛЕКЕТТИК УНИВЕРСИТЕТИНИН ЖАРЧЫСЫ

ВЕСТНИК ОШКОГО ГОСУДАРСТВЕННОГО УНИВЕРСИТЕТА

BULLETIN OF OSH STATE UNIVERSITY

ISSN: 1694-7452 e-ISSN: 1694-8610

№4/2024, 89-98

**ВЕТЕРИНАРИЯ**

УДК: 619:[616-08:618.7]636.4

DOI: [10.52754/16948610\\_2024\\_4\\_9](https://doi.org/10.52754/16948610_2024_4_9)

**COMPARATIVE EFFECTIVENESS OF TREATMENT OF POSTPARTUM  
ENDOMETRITIS IN SOWS**

ТӨРӨТТӨН КИЙИНКИ ЭНДОМЕТРИТТИ ДАРЫЛООНУН САЛЫШТЫРМАЛУУ  
НАТЫЙЖАЛУУЛУГУ

СРАВНИТЕЛЬНАЯ ЭФФЕКТИВНОСТЬ ЛЕЧЕНИЯ ПОСЛЕРОДОВОГО ЭНДОМЕТРИТА  
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## COMPARATIVE EFFECTIVENESS OF TREATMENT OF POSTPARTUM ENDOMETRITIS IN SOWS

**Abstract.** The aim of the research was to study the comparative effectiveness of therapeutic methods of treatment of post-partum endometritis in sows. Two groups of sows with postpartum endometritis of three-breed hybrids of different ages were formed 3 days after farrowing. The use of combination Neostrepin 400 LA + Ute-Roton + Flunex gave the following results: 18 sows out of 20 diseased sows recovered; average duration of the disease was  $4,95 \pm 0,5$  days; time from farrowing to the first insemination decreased to 35,5 days, and from the first farrowing to successful insemination - to 1,5 days; inter-fertility period was 182,5 days; insemination index was equal to 1,5; efficiency of the first insemination - 90%. Complex therapy Streppen LA + Uteroton + Flunex provides recovery of 12 sows out of 20; average duration of the disease -  $6,4 \pm 0,5$  days; time from farrowing to the first insemination - 38 days, and time from the first farrowing to successful insemination - 2,5 days; inter-fertility period - 182,5 days; insemination index was equal to 1,8; efficiency of the first insemination was 60%; 8 sows were culled from the group.

**Keywords:** sows, postpartum endometritis, treatment, Streppen LA, Neostrepin 400 LA, fertilizability

### ТӨРӨТТӨН КИЙИНКИ ЭНДОМЕТРИТИ ДАРЫЛООНУН САЛЫШТЫРМАЛУУ НАТЫЙЖАЛУУЛУГУ

#### Аннотация

Изилдөөнүн максаты - эгиндердеги төрөттөн кийинки эндометритти дарылоонун терапиялык ыкмаларынын салыштырмалуу натыйжалуулугун изилдөө. Изилдөө иштерин жүргүзүү үчүн төрөттөн кийинки эндометрит менен ооруган тоолордон 3 күндөн кийин эки топ түзүлдү. Neostrepin 400 LA + Uteroton + Flunex комбинациясын колдонуу төмөнкүдөй натыйжаларды бергендиги аныкталды: 20 оорулуу сооптун 18и айыгып чыкты; оорунун орточо узактыгы  $4,95 \pm 0,5$  күн; төлдөөдөн биринчи уруктандырууга чейинки убакыт 35,5 күнгө, ал эми биринчи уруктан ийгиликтүү уруктандырууга чейин - 1,5 күнгө чейин кыскарган; аралык мезгил 182,5 күндү түздү; уруктандыруу индекси 1,5; биринчи уруктандыруунун натыйжалуулугу 90% түзөт. Комплекстүү терапия Streppen LA + Uteroton + Flunex 20 үрөндүн 12си айыгууну камсыз кылат; оорунун орточо узактыгы -  $6,4 \pm 0,5$  күн; төлдөөдөн биринчи уруктандырууга чейинки убакыт 38 күн, биринчи тууттан ийгиликтүү уруктандырууга чейинки убакыт 2,5 күн; азыктандыруу аралык мезгил - 182,5 күн; уруктандыруу индекси 1,8; биринчи уруктандыруунун натыйжалуулугу 60% түздү; Топтун ичинен 8 баш ургаачы союлган.

**Ачкыч сөздөр:** мегежиндер, төрөттөн кийинки эндометрит, дарылоо, Streppen LA, Neostrepin 400 LA, туут

### СРАВНИТЕЛЬНАЯ ЭФФЕКТИВНОСТЬ ЛЕЧЕНИЯ ПОСЛЕРОДОВОГО ЭНДОМЕТРИТА СВИНОМАТОК

#### Аннотация

Целью исследований явилось изучение сравнительной эффективности терапевтических методов лечения послеродового эндометрита свиноматок. Для проведения исследований были сформированы две группы свиноматок, больных послеродовым эндометритом, спустя 3 дня после опороса. Установлено, что использование комбинации Неострепин 400 LA + Утеротон + Флунокс дало следующие результаты: из 20 заболевших свиноматок выздоровело 18 голов; средняя продолжительность болезни  $4,95 \pm 0,5$  дней; время от опороса до первого осеменения уменьшилось до 35,5 дней, а от первого опороса до успешного осеменения - до 1,5 дней; межопоросный период составлял 182,5 дней; индекс осеменения равнялся 1,5; результативность первого осеменения - 90%. Комплексная терапия Стреппен LA + Утеротон + Флунокс обеспечивает выздоровление 12 свиноматок из 20; средняя продолжительность болезни -  $6,4 \pm 0,5$  дней; время от опороса до первого осеменения - 38 дней, а время от первого опороса до успешного осеменения - 2,5 дня; межопоросный период - 182,5 дня; индекс осеменения равен 1,8; результативность первого осеменения составлял 60%; из группы было выбраковано 8 свиноматок.

**Ключевые слова:** свиноматки, послеродовый эндометрит, лечение, Стреппен LA, Неострепин 400 LA, оплодотворяемость

## Introduction

One of the main causes of reduced profitability of pig breeding is symptomatic infertility of sows associated with obstetric and gynecological diseases manifested by abortions, stillbirths, weakness of labor activity, acute postpartum endometritis, mastitis and agalactia (Khlopitsky et al., 2021, pp.19-22).

Porcine endometritis is a common disease of the genital organs in sows, which is caused by bacteria, viruses, parasites, fungal toxins and other pathogenic factors. Pigs with endometritis often have decreased appetite, fever, extrados, brown mucous or purulent vaginal discharge, anestrus or irregular heat, infertility or miscarriages. Moreover, swine endometritis can cause severe sepsis and even death (Ganiev et al., 2023).

Noteworthy are the works that study the main pathogens causing endometritis. Thus, Madiev D.J. et al. (2022, pp. 166-168) studied uterine samples of contents from sows with clinical signs of postpartum endometritis. As a result of the studies it was found that the isolated bacteria belonged to the following families: *Enterobacteriaceae*, *Actinomycetaceae*, *Staphylococcaceae*, *Streptococcaceae*, *Bacillaceae*, *Clostridiaceae*, *Bacteroidaceae*, *Porphyromonadaceae*, *Fusobacteriaceae*, *Lactobacillaceae*, *Bifidobacteriaceae*, *Pseudomonadaceae*, *Enterococcaceae*. In most cases, associations of microorganisms were identified during bacteriologic studies of uterine contents of endometritis patients. 133 strains (63,6%) of microorganisms in associations and 76 (36,4%) in monocultures were identified. The isolated microflora was represented by 25 bacterial species from 16 families. Monoinfection and associations of cultures with the establishment of pathogenic properties display the greatest etiopathogenetic significance of bacteria species *Trueperellapyogenes*, *Escherichia coli*.

Many sows remain infertile for longer periods. Even if sows are successfully inseminated, reproductive performance will be reduced, including increased susceptibility of piglets to infection, significant piglet growth retardation, and increased piglet mortality, resulting in unfavorable economic losses (Wang et al., 2020., p. 146; Zhang et al., 2021., p. 663956 ).

Also in sows that became ill after farrowing, compared to clinically healthy animals before insemination, there was a decrease in bactericidal, lysozyme and complement activity of blood serum, neutrophil absorptive function and phagocytosis completion index, increased content of circulating immune complexes and their pathogenicity coefficient. During the period of gestation, there was a decrease in the amount of total immunoglobulins, phagocytic activity of neutrophils, their absorptive function, phagocytosis completion and phagocyte reserve potential (37-39 days), absorptive and metabolic functions of neutrophils, phagocytosis completion index and phagocyte reserve potential (78-80 days). During the lactation period they showed a decrease in lysozyme and complement activity of blood serum, the content of total immunoglobulins, an increase in the level of circulating immune complexes and their pathogenicity coefficient, decrease in neutrophil absorptive function, phagocytosis completion index and phagocyte reserve potential (day 5-7), phagocytic number, phagocytosis completion index, stimulated NST-test and phagocyte reserve potential (day 18-20) (Shakhov et al., 2023, pp. 51-56 ).

For the treatment of sick sows antimicrobials of a wide spectrum of action, general stimulants that increase the resistance of the organism, and myotropic drugs that increase the contractile activity of smooth muscle structures of the uterus and mammary gland are used (Blednova et al., 2022, pp.34-38; Efremenko et al., 2024, pp.48-51).

Thus, Terentyeva N. et al. (2024, pp.54-58) studied the effectiveness of therapeutic measures in postpartum endometritis. Treatment of sows of the control group included: antibacterial drug Amoxicard on day 1-5 (10 ml, intrauterine) + drug Oxytocin on day 1-3 (0.5 ml, intrauterine) + Viapene as prophylaxis and treatment of inflammatory processes once (60 g, intrauterine). In the experimental group the treatment was carried out according to the protocol: Meganil preparation as

anti-inflammatory processes on day 1 (10 ml, intrauterine) + Primalact preparation once (20 ml, intrauterine) + Solamox antibacterial preparation on day 3 (10 ml, intrauterine). The studies allow us to conclude that the treatment led to recovery of all animals of the experimental group, i.e. its effectiveness amounted to 100%. The effectiveness of treatment in the control group was 66,6%.

Kotsarev V.N. et al. (2019, pp. 182-184) found that the therapeutic effect after a single intrauterine administration of dinopen to sows was 85,7% and taking into account animals with repeated administration of 95,2%, and when using enrocide - respectively 73,7% and 84,2%. The application of antimicrobial preparations to sows had a sanitizing effect on the mammary gland. The number of mammary gland lobes affected by subclinical mastitis with the use of dinopen decreased by 2,4 times, with the use of enrocide - by 1,8 times.

In veterinary practice, nonspecific therapies are also used to treat postpartum endometritis in pigs. The authors believe that these drugs have potential value for use as a new method, alternative to antibiotics, for the treatment of endometritis in sows (Terentyeva et al., 2023, pp. 245-249). Thus, Ye et al. (2021, pp. 746-754). conducted a study of recombinant lysostaphin for the treatment of sow endometritis. Clinical recovery, bacterial clearance and reproductive performance of sows with endometritis were investigated. We found that a dose of 400 units (400 units of lysostaphin/tablet/times, repeated once on day 3, twice in total, with 10% injection of oxytetracycline into the uterus as a control) was the most effective treatment. *Staphylococcus aureus* was the most common finding (34%, n=188), followed by *Streptococcus* (32%, n=181), *Escherichia coli* (19%, n=104), and other bacilli (15%, n=83) before drug treatment. Lysostaphin administration resulted in a significant ( $p < 0,01$ ) decrease in *S. aureus* ( $0,18 \pm 0,25$  from  $4,57 \pm 0,33$ ) and *Streptococcus* ( $0,11 \pm 0,14$  from  $3,88 \pm 0,29$ ), and a significant ( $p < 0,05$ ) decrease in *E. coli* ( $0,55 \pm 0,42$  from  $3,11 \pm 0,14$ ). Mixed infections (83%) predominated before treatment, in contrast to single infections (61%) after treatment. Large-scale trials were conducted to test the clinical efficacy of lysostaphin in sow endometritis. The mean cure rate of lysostaphin at a dose of 400 units in sow endometritis (82,5%) was higher than that of the antibiotic group (72,17%). In addition, our results showed that intravaginal administration of lysostaphin had no adverse effect on the reproductive performance of sows.

Shakhov A.G. et al. (2020) presented the results of studying the therapeutic efficacy of drugs «Propig» and «Tsipropig» in acute postpartum purulent-catarrhal endometritis in sows in the conditions of industrial pig breeding complex. It is established that complex preparations «Propig» and «Cipropig», containing antibiotics with a wide spectrum of antimicrobial action, alpha- and gammainterferons porcine recombinant, possessing immunomodulatory activity, vitamins A and E, increasing antioxidant status of the organism, are highly effective in the treatment of sows with acute postpartum purulent and catarrhal endometritis, which allows us to recommend them for use in pig breeding (Shakhov et al., 2020, pp. 83-88).

Thus, diseases of the reproductive system are a significant problem in modern pig breeding. The existence of pathological processes in the reproductive apparatus, primarily pathogenic and potentially pathogenic microorganisms (*Escherichia coli*, *Streptococcaceae*, *Proteus vulgaris*, *Candida*, *Mucor*, etc.) complicate the process of animal fertilization. For this reason, infertility increases, the percentage of main sows in the herd structure decreases, which reduces the level of pork production per main sow. Timely treatment of postpartum endometritis of sows allows to keep the health of sows and gilts in suckling period, as well as significantly increase the safety of the herd and profitability of the enterprise.

In this regard, the aim of the research was to study the effectiveness of treatment methods for postpartum endometritis in sows. The object of research were pigs, sick with postpartum endometritis, of three-breed hybrid (F1) breed of different age, 3 days after farrowing, with an average weight of 280 kg, in the number of 40 heads.

The diagnosis was established comprehensively in accordance with the «Methodological guidelines for diagnosis, therapy and prevention of diseases of reproductive organs and mammary gland in pigs» (No. 13-4-03/0007 05.02.01), approved by the Department of Veterinary Medicine of the Ministry of Agriculture of the Russian Federation.

The following were taken into account:

1. anamnestic and epizootologic data;
2. clinical signs: oppression, decreased appetite, increased body temperature, decreased milk secretion, unnatural posture, turbid mucous or mucopurulent exudate of yellow to green color, vaginal mucosa was hyperemic and edematous.

The following were used in the work:

1. Uteroton is a non-hormonal drug that has a blocking effect on beta-adrenoreceptors of myometrium, which promotes the activity of endogenous oxytocin, resulting in increased contractions of uterine and mammary smooth muscle. It is an antagonist of catecholamines, has a pronounced anti-stress effect.

2. Flunex is a non-steroidal anti-inflammatory drug. Flunixin, which is a part of the drug, is a non-selective inhibitor of cyclooxygenases, inhibits the synthesis of prostaglandins E - inflammatory mediators, which determines its analgesic, anti-inflammatory, antipyretic and antitoxic effect.

3. Streppen LA is a complex antibacterial drug of prolonged action. Procainebenzylpenicillin and benzatinbenzylpenicillin, which are part of the drug, are antibiotics from the group of long-acting penicillins. They have a broad spectrum of bactericidal action, with a predominant effect on Gram-positive microorganisms and treponemes.

4. Neostrepine 400 LA is a complex antimicrobial preparation of prolonged action in the form of suspension for injection. The combination of benzylpenicillin procaine and benzathinebenzylpenicillin with dihydrostreptomycin has a synergistic effect, providing a wide range of bactericidal action against Gram-positive and Gram-negative microorganisms.

In order to study the efficacy of our proposed complex treatment, two groups of sows of different ages were formed from the total number of sows with postpartum endometritis 3 days after the poll, 20 heads in each group (Table 1). Feeding and housing conditions were identical.

**Table 1** Schematic of the research experience

Animal group(n=20)	Drugs used
1 (experimental)	Neostrepine 400 LA (intramuscularly, once a day, for 3 days, 1 ml per 20 kg of animal weight. Shake the drug thoroughly before use); Uteroton (intramuscularly, 10 ml per animal); Flunex (intramuscularly, 2 ml per 45 kg).
2 (control)	Streppen LA (intramuscularly, 1 ml of the drug per 20 kg of animal body weight, not more than 10 ml in one injection site. Repeated injection after 48 hours); Uteroton (intramuscularly, 10 ml per animal); Flunex (intramuscularly, 2 ml per 45 kg).

Therapeutic efficacy was evaluated before treatment, on the third, fifth and seventh days from the start of treatment according to the following criteria:

1. Positive dynamics (daily general examination of animals, determination of body temperature by rectal thermometer, examination of pulse by heartbeats and determination of respiration by counting inhalations (or exhalations) during one minute by movements of the chest, abdominal wall, wings of the nose).

2. Duration of treatment, days.

To determine the economic damage, which was prevented as a result of veterinary and sanitary measures, we used the «Methodology for determining the economic efficiency of veterinary measures», compiled by Y.E. Shatokhin and I.N. Nikitin.

Determined:

- total (actual) (U): economic damage from reduction of animal productivity (U2);
- prevented economic damage (Pu);
- veterinary costs (Vz);
- economic effect obtained as a result of treatment measures (Ev);
- economic effect of treatment measures per 1 ruble of costs (Er).

Statistical processing of experimental data was carried out using the statistical analysis package for Microsoft Excel®.

We selected 40 sows of different ages (Table 2) to study the efficacy of drugs in postpartum endometritis of sows.

**Table 2** *Main clinical signs of postpartum endometritis in sows*

Number of animals, heads	Clinical signs
40 (100%)	
27 (67,5%)	Oppression, decreased appetite
13 (32,5)	Increase in body temperature by 0,5-1,0°C
4 (10%)	Increase in body temperature by 1,0°C or more (fever)
36 (90%)	Decrease in milk secretion
29 (72,%)	Urination posture accompanied by moaning and depressed state of the sow
40 (100%)	Cloudy mucous or mucopurulent exudate of yellow to green color
38 (95%)	Hyperemia and swelling of the vaginal mucosa

Postpartum endometritis was most often registered during clinical examination in animals as a complication after delivery 3-5 days after farrowing. At clinical examination of a sick sow her general condition in most cases does not change, in some weakened sows were noted significant oppression, increased body temperature by 0,5- 1,0°C, sometimes up to 40-41,8°C (fever), there was a decrease in appetite, decreased milk secretion, decreased viability of piglets. The sow was often forced to adopt an atypical resting posture for urination. Depending on the form of inflammation, a cloudy mucous or mucopurulent exudate was constantly discharged from the vagina.

The sows included in the experiment were continuously monitored for seven days. Attention was paid to appetite and water consumption, body temperature, pulse and respiration rates, genital and mammary glands, vaginal contents, viability of newborn piglets and their safety at weaning (Table 3).

**Table 3** *Comparison of the therapeutic efficacy of treatment regimens*

Animal group	Days of observation			
	Before treatment	3rd	5th	7th
Temperature, °C (physiological norm 38 – 39,5 °C)				
1	40±0,5	39,3±0,2	38,6±0,1	38,0±0,3
2	40±0,5	39,4±0,4	38,8±0,2	38,0±0,5
Heart rate, beats/min (physiological norm 60 - 80 beats/min).				
1	83,1±1,0	83,1±1,0	77,0±0,8	69,8±0,9
2	82,9±0,5	83,4±1,0	81,0±0,81	72,0±0,6

Respiration, respiratory movement/min (physiologic norm 15 - 20 respiratory movements/min)				
1	23,0±0,5	22,0±0,5	19,8±0,25	17,0±1
2	22,0±0,8	23,0±0,5	20,0±0,1	17,0±1,3
Clinical examination				
1	General condition - satisfactory, appetite decreased, mammary glands slightly thickened, painful on palpation, yellowish-green discharge	Appetite is preserved, general condition is satisfactory. Mammary glands slightly thickened, slight painfulness on palpation. Yellow-colored discharge	General condition is satisfactory, mammary glands are not compacted, painless on palpation. No discharge	His general condition and appetite are normal.
2	General condition - satisfactory, appetite reduced, mammary glands slightly thickened, painful on palpation, discharge of yellowish-green color	General condition is satisfactory, appetite is preserved. Mammary glands are slightly thickened, slight painfulness on palpation. The discharge is yellow in color.	Appetite is good, general condition is good, mammary glands are painless on palpation, slightly thickened. The discharge is light yellow in color.	Appetite is good, general condition is good.

On the seventh day from the start of treatment, the results of treatment were evaluated.

On the first day of treatment the general condition of sows in both groups was satisfactory. A decrease in appetite was observed in the animals. Temperature, pulse and respiration were also higher than normal in both experimental and control groups. There was observed thickening of mammary glands, at palpation there was painfulness of mammary glands, animals behaved restlessly.

In the process of treatment and after the end of treatment in sows of experimental and control groups the following dynamics of clinical signs were observed: swelling of mammary glands and vaginal discharge disappeared, appetite normalized, body temperature, pulse and respiration were within physiological norm.

The whole course of treatment in the first experimental group was  $4,95 \pm 0,5$  days, and in the second control group –  $6,4 \pm 0,5$  days. On the seventh day from the beginning of treatment the results of treatment were evaluated. Those animals with no clinical signs of disease and no pathogenic microorganisms in vaginal mucus on the fifth day of the experiment were considered recovered (Table 4).

At insemination of treated sows, after application of Streppen LA, eight animals had purulent discharge, indicating the relative effectiveness of Streppen LA. After application of Neostrepin 400 LA, there were fewer animals with discharge - two heads.

Further observation of the animals revealed that the percentage of successfully sows sown in the experimental group significantly exceeded that of the control animals - 90% vs. 60%, respectively.

**Table 4** Results of studies on the effectiveness of comparable drugs in postpartum endometritis of sows

Indicators	Experience	Control
Number of animals, head	20	20
Diseased, head	20	20
Average duration of disease, days	$4,95 \pm 0,5$	$6,4 \pm 0,4$
Recovered, head	18	12

Safety, %	90	60
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After complex treatment of acute postpartum endometritis of sows with antibiotic Neostrepin 400 LA in the first experimental group the time from farrowing to first insemination was reduced to 35-36 days, while in the control group the number of days was 36-40. The time from the first farrowing to successful insemination was also reduced to 1-2 days, while in case of using the treatment regimen with antibiotic Streppen LA the number of days from the first farrowing to successful insemination was 2-3 days. Insemination index data for the first treatment regimen (using Neostrepin 400 LA) and the second treatment regimen (using Streppen LA) are significantly different: 1,5 (good) and 1,8 (satisfactory), respectively. The insemination efficiency is in favor of Neostrepine 400 LA, exactly as in the previous indicators: 90% versus 70% with the administration of Streppen LA. In the experimental group of 20 sows, two heads were culled during the study period, while in the control group - eight.

To determine the economic damage, which was prevented as a result of veterinary and sanitary measures, we used the «Methodology for determining the economic efficiency of veterinary measures», compiled by Y.E. Shatokhin and I.N. Nikitin.

The economic effect from the disease of postpartum endometritis in sows is the result of milk loss and, accordingly, the daily weight gain of piglets.

**Table 5** Cost-effectiveness of treatment of acute postpartum endometritis of sows and pigs

Animal group	Economic efficiency indicators				
	Total economic damage U, rubles.	Veterinary costs Zv, rub.	Prevented economic damage Pu, rubles.	Economic effect Ev, rubles.	Economic effect per ruble of costs Er, rub.
1	268 386,8	11 684	22 831	11 147	0,95
2	298 079,4	12 124	20 714	8 590	0, 71

Payback per ruble of invested costs in the experimental and control groups of sows receiving complex treatment amounted to 0,95 rubles and 0,71 rubles, respectively.

Thus, the following conclusions can be drawn:

1. In sick sows the general condition in most cases did not change, in some weakened sows significant oppression, increase in body temperature by 0,5-1,0°C, sometimes up to 40-41,8°C (fever), there was a decrease in appetite, decreased appetite, decreased milk secretion, decreased viability of piglets, all sows had mucous or mucopurulent exudate of yellow, green colors, most of the vaginal mucosa was hyperemic and edematous.

2. As a result of the conducted research, it was found that the use of combination Neostrepin 400 LA + Uteroton + Flunex gave the following results: 18 animals out of 20 diseased animals recovered; average duration of the disease was 4,95±0,5 days; time from farrowing to first insemination decreased to 35,5 days, and from first farrowing to successful insemination - to 1,5 days; inter-fertility period was 182,5 days; insemination index was equal to 1,5; efficiency of the first insemination - 90%; two sows were culled from the group due to reproductive disorders.

Complex therapy Streppen LA + Uteroton + Flunex provides recovery of 12 sows out of 20; average duration of the disease - 6,4±0,5 days; time from farrowing to the first insemination - 38 days, and time from the first farrowing to successful insemination - 2,5 days; inter-pregnancy period - 182,5 days;



insemination index - 1,8; first insemination efficiency was 60%; eight sows were culled from the group due to reproductive disorders.

3. When comparing the economic efficiency of the conducted measures, it was established that in the experimental group with the use of Neostreptin 400 LA the economic efficiency obtained as a result of treatment measures amounted to 11,147 rubles. Pay back per ruble of invested costs amounted to 0,95 rubles.

In the control group using Streppen LA in the complex treatment of sows, the economic efficiency obtained as a result of treatment measures is 8,59 rubles, and the payback per ruble of invested costs – 0,71 rubles.

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