Stimulation of sexual function of cows as a method of herd reproduction increase

A Lishchuk, N Malakhova and O Piskunova
Oryol State Agrarian University named after N.V. Parakhin, 69, General Rodin Street, Orel 302019, Russian Federation
E-mail: anatomija2013@yandex.ru

Abstract. The current political situation in the world, international sanctions applied to Russia; force us to pay more attention to the development of domestic sectors of the agro-industrial complex, including dairy cattle breeding. One of the most important conditions for the restoration and development of dairy farming and increasing its productivity in the Oryol region and the Russian Federation as a whole is rationally organized reproduction of the herd. The purpose of the study is to analyze the reasons of the low rate of fertilization of cows in livestock farms in the Oryol region, ways and methods for regulating the fertility of cattle.

1. Introduction
Intensification of the herd reproduction constitutes the main part of the work to increase milk production, which is the most actual in connection with the necessity to develop domestic dairy cattle breeding in the conditions of sanctions applied to Russia. The growth of livestock production along with feeding, care and maintenance primarily depends on the level of organization of the herd reproduction. Therefore, a base, which ensures the acceleration of the intensification of the reproduction of cattle, is created in each farm. [1, 2].

The importance of the problem caused the necessity to summarize the latest scientific data and best practices on the main issues of broodstock reproduction - evaluation and selection of animals within the conditions of industrial milk production technology, the effectiveness of different rates of annual renewal of broodstock, directive raising of young stock, improving organizational methods of improving the reproductive ability of cows. As shown our previous studies, the low fertility of cows in the first months after calving in livestock farms in the Oryol region can be explained by the abnormal course of the postpartum period as a result of violation of the feeding and exploitation of animals conditions, as well as the fact that the involution of the reproductive organs in animals in industrial conditions ends not earlier than 40-60 days after calving [3].

In cases, when the cows don’t come into the estrus for 3 month or more after calving, and in order to prevent such situation in highly productive herds it is necessary to stimulate the sexual function with hormonal preparations [4, 5].

2. Materials and methods
The study material was cows of the black-and-white breed in the age 3-5 years, the first 2 months after calving.

The conditions of care and maintenance of animals were taken into the account when determining the causes of disease in cows.
Diagnosis of the disease was established by the rectal method and using ultrasound. Ultrasound examination was performed on the device DRAMINSKI iScan Standard (Poland).

During rectal palpation, the ovaries of acyclic infertile cows were of small size, dense consistency, and there were no follicles and yellow body in ovary.

The echographic examination showed that the ovaries with the hypofunctional state do not have an echogenic formation.

To study the homeostasis of lactating infertile animals, before the experiment, blood tests were carried out they were taken before feeding and milking the animals in the morning and examined on the following indicators: carotene, calcium, phosphorus, determination of reserve alkalinity, amount of sugar and total protein.

The results of the biochemical studies of blood serum are shown in table 1.

Table 1. The result of a blood test of cows before treatment

|                | Carotene, mg% | AR, mg% | Total protein, mg% | Calcium, mg% | Phosphorus, mg% | Sugar, mg% |
|----------------|---------------|---------|--------------------|--------------|-----------------|------------|
| Average on group | 0.402         | 462     | 6.00               | 10.5         | 4.7             | 40.4       |
| Reference range  | 0.416-2.208   | 450-540 | 7.2-8.6            | 10.0-12.5    | 4.5-6.5         | 40-60      |

Analyzing the results of the blood test of cows, it should be noted that the content of calcium, phosphorus, sugar, reserve alkalinity is at the lower limit of the physiological norm, and the content of carotene, total protein in some cows do not reach it. This phenomenon is due primarily to the fact that the diet of cows is lack of digestible protein and carotene; it is because of prolonged and improper storage of feed.

According to the results of the biochemical test of blood serum, it can be assumed that one of the causes of ovarian hypofunction is a metabolic disorder in the animal’s body, as well as the occurrence of a stressful state of highly productive cows because of their more intensive exploitation.

Breeding of cattle dairy breeds aimed primarily at productivity increasing. In cows of some local dairy breeds of the old selection, a balance between milk yield and body condition is maintained. In dairy cows intensively selected for high productivity, this balance is disturbed. The level of milk yield depends on the number of secretory cells of the mammary gland and hormonal factors, as well as on the total physiological state of the cow. In highly productive cows, the mammary gland is developed much better than in medium- and low-productive cows. The amount of nutrients circulating in the blood and their balance limits the milk yield. The amount of these substances depends on feed intake and their pool in the body.

The need for nutrients, as well as their use, is regulated by the milk yield and the hormonal system in animals. Satisfaction of need may be limited by physiological impossibility of consuming and digesting the required amount of feed.

With a decrease in fatness, the hypothalamus reduces the production of gonadotropin-releasing hormone, which regulates the production of sex hormones in the pituitary gland. As a result, the cows do not come into the estrus for a long time, or their follicle maturation and ovulation are delayed.

In this regard, study of the blood test of cows on the content of follicle-stimulating, luteinizing hormones, progesterone, estradiol, and testosterone was conducted.

According to the Table 2, the level of follicle-stimulating, luteinizing hormones, progesterone, testosterone in the blood of cows with ovarian hypofunction is below the physiological norm.

Blood tests showed and permit to conclude that the level of metabolism in cows in the second half of the winter-stall period is at the lower limit of the physiological norm, which is due to the level of feeding of animals in the winter-stall period.
Table 2. Results of a blood test of cows with diagnosis of ovarian hypofunction on hormonal status

| Index number | FSH, mEd/ml | LH, mEd/ml | Progesteron, nmol/l | Estradiol, pmol/l | Testosterone, nmol/l |
|--------------|-------------|------------|---------------------|------------------|---------------------|
| Average on group range | 9.4 | 9.5 | 1.7 | 108.4 | 0.85 |
| Reference range | 13.4±1.9 | 10.8±1.7 | 2.19±0.59 | 115.2±16.0 | 1.0±0.21 |

In addition, in some farms, tethered animal keeping without providing active exercise is practiced. The high concentration of animals and their intensive use determine the effect of stress factors on animals that lead to a decrease in the hormonal range; inhibit the preovulatory release of luteinizing hormone into the blood, which provokes a delay of ovulation.

3. The study of the structure of the modified lead-tin-base bronze

Stimulation of sexual function in cows was performed using the synthetic analogue of the releasing-hormone "Surfagon" and the analogue prostaglandin PGF2α "Estrofantin" on two treatment regimens: OvSynch (GnRH - PGF2α - GnRH) and SelectSynch (GnRH - PGF2α) [6].

The drug "Surfagon" is an analogue of natural GnRH (gonadotropic releasing hormone), the synthesis of which was developed in the laboratory of peptide synthesis at the All-Russian Cardiology Research Center, is ten times more active than similar foreign drugs [7].

Synthetic analogues of gonadotropin-releasing hormone - GnRH act on the gonad through the activation of the anterior pituitary gland. These drugs fasten the maturation of follicles, ovulation and luteinization of the follicular cysts walls. The injection of drugs of this group in the presence of an actively functioning yellow body contributes to the additional secretion of LH and can be used for reducing of early embryonic mortality [8].

The prostaglandin analogue PGF2α "Estrofantin" causes the reverse development of not only the yellow body or luteal cyst, but also other luteal structures of the ovarian cortex.

The cows of the first experimental group were injected intramuscularly with a synthetic analogue of gonadotropic releasing hormone "Surfagon" at a dose of 2 ml and after 7 days - an analog of the prostaglandin PGF2α "Estrofantin". Then, 2 days later, releasing hormone (GnRH – PGF2α –GnRH) was injected. Insemination was performed 16-24 hours after the last treatment without or by identifying the estrus (OvSynch scheme).

The cows of the second experimental group were injected intramuscularly with a synthetic analogue of gonadotropic releasing hormone "Surfagon" at a dose of 2 ml and after 7 days - an analog of the prostaglandin PGF2α "Estrofantin" (GnRH - PGF2α) according to the SelectSynch scheme.

After the treatment, blood on the level of hormones examination was taken of the cows of the first and the second groups (Table 3).

Table 3. The results of blood on the level of hormones examination of cows after the application of treatment regimens

| Index | FSH, mlU/ml | LH, mlU/ml | Progesterone, nmol/l | Estradiol, pmol/l | Testosterone, nmol/l |
|-------|-------------|------------|---------------------|------------------|---------------------|
| First group (OvSynch scheme) | 13.6 | 11.6 | 1.9 | 135.5 | 0.95 |
| Second group (SelectSynch scheme) | 12.8 | 10.3 | 1.7 | 110.5 | 0.95 |
| Reference range | 13.4±1.9 | 10.8±1.7 | 2.19±0.59 | 115.2±16.0 | 1.0±0.21 |
After the application of drugs for treatment in the experimental groups, the content of follicle-stimulating, luteinizing hormones, progesterone, estradiol, and testosterone reached the physiological norm.

The following results were obtained during insemination.

In the first group (OvSynch scheme) 75% of the total number of treated animals came to the estrus, 25% of the animals showed no signs of the estrus, but all animals had a pregnancy at 30–45 days.

In the second group (the SelectSynch scheme), 60% of the total number of treated animals came into the estrus, 40% of the animals showed no signs of estrus, and all the animals had a 30–45 day pregnancy.

4. Conclusion
Cows are fertilized when they reach certain fatness. If by the time of calving the cow has not accumulated energy stores, which are concentrated in the fat depot, fertility decreases with a rapid decrease in fatness in the first weeks after calving. Ovarian hypofunction is usually found in cows with low body fatness. At the beginning of lactation in highly productive cows, most of the nutrients of feed and part of body store are used for milk production. Insufficient intake of energy in the feed during the first months of lactation increases its deficit. Lack of energy creates an incompatible situation between maintaining a high level of milk yield, normal metabolic processes in the body and reproduction, as all of these goals require energy. In the after calving period, up to 30% of the energy of the milk yield is provided by body store.

With inherited high producing activity, the cows after calving lower their body condition more strongly than the mid productive ones. That is why they have a longer service period than mid productive cows.

In clinical and gynecological studies of cows in farms of the Oryol region, we found signs of ovarian hypofunction.

A biochemical study of the blood of cows with hypofunction of the ovaries has established that the course of redox processes in the body is at the lower limits of the physiological norm.

After conducting an experiment on the comparative efficacy of the use of hormonal drugs Estrophanthin and Surfagon during ovarian hypofunction study, we found out that the greatest therapeutic efficacy is achieved using the OvSynch scheme. The drugs using causes the growth of follicles in the ovaries, and this causes sexual estrus and estrus in animals.

Stimulation of high- and med-productive healthy well-fed cows should begin in the first month after calving, in order to achieve earlier estrus and fertilization of cows.

The effectiveness of all measures aimed at improving reproduction index will depend on whether the feeding is corresponded the genetic facilities of cows according milk productivity.

Thus, the use of the synthetic analogue of the hormone “Surfagon” and the prostaglandin PGF2α analogue “Estrophantin” according to the OvSynch scheme for ovarian hypofunction is biologically justified and practically confirmed by a high therapeutic effect on the example of its use in farms in the Orel region. After such a complex treatment, both the percentage of cows that came to the estrus and the effectiveness of their insemination in induced hunt are increased up to 100%.

References
[1] Golovan V T, Kulik Yu V Dakhuzhev Yu G, Galicheva M S 2008 The present and the future of reproduction of cows in the Kuban New Technology 6 19–22
[2] Klyuchnikova N F 2007 Biological and zootechnical aspects of fertility of cows in the Far East: the dissertation of the doctor of agricultural sciences (Khabarovsky) p. 368
[3] Nezhdanov A G, Lobodin K A, Dyulger G P 2008 Hormonal control over the reproduction of cattle Veterinary Medicine 1 3–7
[4] Plemyashov K V, Zakharov P G, Suller I L, Oleksiyevich. A A 2013 Problems of the reproduction of cattle. Ways of solution Tutorial 129
[5] Piskunova O G, Kleimyonoova N V, Malakhova N A, Smagina T V, Lishchuk A P 2013 The ways of increasing the effective potential of the cattle dairy productivity in the Orel region under The conditions of russia's wto accession Vestnik OrelGAU 6(45) 68–70
[6] Rabiee A R, Lian I J and Stevenson M A 2005 Efficacy of Ovsinch Program on Reproductive Performance in Dairy Cattle: A Meta-Analysis J. of Dairy Sci. 89 2754

[7] Stevenson J S, Phatak A P 2005 Insemination at a astrus Induced by Ppre-synchronization before Fpplication of Synchronized estrus and Ovulation J. of Dairy Sci. 88 399

[8] Topuria L Yu 2012 The main reasons of the low reproductive ability of cows News of the Orenburg State Agrarian University 4(36-1) 76–77