Introduction of biotechnology in animal breeding, as a factor of improving its efficiency

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Abstract. The article presents the results of the introduction of the biotechnological method to improve the reproduction of the herd of Holstein cattle. Comparative data on the growth of calves obtained in different ways are given: from artificial insemination and transplantation of embryos during the growing period - from birth to the age of 18 months. It was found that calves obtained from the biotechnological method grew faster than their peers obtained from artificial insemination. The difference was 18.3 kg in favor of the heifers of the experimental group. The largest average daily gain in live weight was observed during the period from 12 to 18 months - 50 g is naturally in favor of the heifers of the experimental group. The difference in live weight during the first insemination between the heifers of the studied groups was 10.0 kg or 2.5%. The fertility rate was +2.0 absolute percent. The insemination index was excellent and amounted to a difference between experimental groups of +0.6 absolute growth. The conditional profit from the cultivation of Holstein heifers obtained by the method of embryo transplantation amounted to 267.8 thousand rubles. Profitability was 22.4 percent.

Obtaining breeding animals by the method of embryo transplantation allows accelerating the creation of genealogical lines of animal types, highly productive herds suitable for intensive technologies, and increases the importance of female ancestors and the role of uterine families in breeding and breeding. The proliferation of mutant genes of positive action in nature, detection of carriers of recessive genes and timely calibration, improves the accurate assessment of animals by a set of traits, ensures early detection and use of the best breeding animals [1].

Of particular interest is transplantation of embryos for breeding enterprises, since in modern dairy cattle breeding, the quality of the bulls used in artificial insemination is crucial for increasing the productivity of cows due to genetic factors. The high quality of the bulls is ensured by the selection of parents for their receipt and the subsequent selection of the best-performing daughters [2,3].

The purchase of breeding bull-calves from abroad is associated with significant financial costs for the breeding enterprises and the long adaptive period of the bull-calves after transportation. Getting bull-calves by transplantation directly allows you to minimize financial costs, achieve accelerated breeding of genetically high-value animals of a new generation, grow young animals adapted to the climatic
conditions of the region and further use them to obtain sperm products that will be available for agricultural producers. Germ transplantation has become the standard procedure for obtaining bulls from outstanding cows. Most of the bulls (80%) used for artificial insemination in the world were obtained by embryo transplantation, and their proportion continues to increase [4].

The essence of this technology is to obtain multiple embryos from the reproductive apparatus of a highly productive cow (donor) and transplant them into the reproductive apparatus of less valuable cows (recipients). The possibility of inducing hormonal stimulation of superovulation in a donor cow, that is, artificial stimulation of multiple follicles, varying from 5 to 20 ovulating eggs, allows using recipient cows to grow a large number of genetically valuable offspring from a donor cow [5].

In this connection, this direction of biotechnology, in the last decade, is becoming increasingly important for the practice of animal husbandry and attracts the close attention of researchers around the world. As practice shows, the use of embryo transplantation technology in reproduction can accelerate breeding progress in animal husbandry up to 7 times, compared with classical breeding methods. This is explained by the fact that up to 30 or more embryos per year can be washed from one highly productive cow and up to 20 or more calves can be obtained by transplantation to recipients [6,7].

Studies on the use of artificial insemination and transplantation of cattle embryos were carried out in the conditions of the Southern Federal District. As donors, pre-selected Holstein cows with an average live weight of 540-660 kg were used, with milk yield from 9000 kg of milk and above, with a fat content in milk of 3.5-4.1%. The recipients were cows of the Holstein cattle with a physiological state of 70-90 days after calving, and heifers - upon reaching a live weight of 360-380 kg and a height at the withers of 126 cm.

The content and feeding of donor cows, recipient heifers, and calf grafts were the same, carried out according to the technology adopted in this farm, taking into account existing norms and standards. The resulting embryos were in the developmental stage of the late morula, early and late blastocytes. Then they were evaluated, cultured and, therefore, transplanted. Embryos having the correct shape, light cytoplasm, the presence of a whole undamaged membrane were considered biologically complete, the maturity level from the moment of fertilization to their complete extraction corresponded. After 35-40 days, the recipients were checked for pregnancy with an ultrasonic device. For more reliable information after 2 months, the animals were checked rectally. According to studies, it was found that the survival rate of embryos is: in cows up to 50%, in heifers 35-40%.

Calving took place on time and without any complications. Calves obtained by embryo transplantation were born without morphophysiological abnormalities and were no different from ordinary calves.

To assess growth and development, 2 groups of experimental animals were formed. The control group consisted of heifers obtained by artificial insemination, and the experimental group consisted of calves obtained by embryo transplantation. Observation of the dynamics of live weight was carried out at birth and at the age of 3, 6, 12 and 18 months. Productive qualities of calves were determined according to the methods adopted in zootechnics. The insemination index was determined by the number of inseminations spent on one fertilization. It was calculated by dividing the total number of inseminations in the herd by the number of pregnancies.

An important indicator of the reproductive ability of the breeding stock is the fertility of cows and heifers and the number of inseminations required for fertilization (insemination index). Fertility is understood as the percentage of cows and heifers fertilized after the first insemination. Fertility from the first insemination was determined by the percentage of queens who did not come to hunt 60-85 days after insemination.

Growth rates reflect the growth rate over a single period of time. Knowledge of the growth characteristics of farm animals in certain age periods makes it possible to influence the proportions of their physique during these periods by specific feeding and keeping conditions and to achieve better development of articles that are important for this direction of productivity. The productivity of newborn calves was determined by observing changes in live weight [8,9].

The change in live weight was determined by weighing the calves at birth, at 3, 6, 12 and 18 months
of age. Weighing was carried out in the morning before feeding the calves. The dynamics of live weight are presented in table 1.

Table 1. Dynamics of live experimental calves, kg, M±m.

| Age, months | Group | Experienced to control |
|-------------|-------|------------------------|
|             | control | experienced            |                          |
| at birth    | 34.06±0.42 | 36.9±0.40           | 108.30%                 |
| 3           | 94.03±0.51 | 99.52±0.71           | 105.83%                 |
| 6           | 168.76±1.43 | 174.81±2.63*        | 103.59%                 |
| 12          | 309.52±7.51 | 320.38±8.10***      | 103.50%                 |
| 18          | 421.81±12.71 | 440.10±15.51***    | 104.33%                 |

Note: *Р≥0.95, **Р≥0.99, ***Р≥0.999.

The heifers of both groups had a rather high growth rate. At birth, the difference in live weight between groups was 2.84 kg, which was 8.3% as a percentage. From 3 months of age, the animals of the experimental group had the highest growth rate, which amounted to 5.49 kg or 5.03%, at 6 months - 6.05 kg or 6.23% (P≥0.95). At 12 months - 10.6 kg or 5.67% and at 18 months the difference was 18.29 kg or 2.91% (P≥0.999). The superiority in these age periods remained behind the growth dynamics of heifers obtained by artificial insemination (4.64%). The absolute increase in a unit of body mass per unit time does not characterize the true growth rate. Absolute growth is understood to mean an increase in the live weight of young animals over a certain period of time (day, decade, month, year), expressed in kilograms [10]. The data are presented in table 2.

Table 2. Absolute increase in live weight of experimental calves, kg.

| Age, months | Group | Experienced to control |
|-------------|-------|------------------------|
|             | control | experienced            |                          |
| 0-3         | 59.97  | 63.62                  | 106.08                  |
| 3-6         | 74.73  | 75.29                  | 100.70                  |
| 6-12        | 140.76 | 145.57                 | 103.41                  |
| 12-18       | 112.29 | 119.72                 | 106.61                  |
| 0-18        | 387.75 | 403.20                 | 103.98                  |

According to the results of calculating the absolute increase in live weight of the experimental calves, it was revealed that the experimental group names a slightly larger value of the absolute increase. In groups of 0-3 months, the difference was 3.65 kg, which in percentage terms was 6.08%. In the period from 3 to 6 months, the difference between the experimental groups was slightly less than 0.56 kg or 0.7%; in 6-12 months, the experimental group was 4.81 kg higher than the control, which was 3.41% in percentage terms. The greatest differences were noted during the period from the 12th to the 18th month, the difference was 7.43 kg or 106.61%. The average value for all sex and age periods from birth to 18 months between the experimental and control groups was 15.4 kg or 3.98%.

Growth rate - the growth of the animal per unit time. Speed is an absolute measure of growth over the period in which it is taken into account. When using the weight method, it is measured by the gain per day, expressed in grams [10].

Table 3 presents data on the average daily growth of experimental calves of different age and gender groups.

Table 3. The average daily gain in live weight of experimental calves, g.

| Age, months | Group | Experienced to control |
|-------------|-------|------------------------|
|             | control | experienced            |                          |
| 0-3         | 670    | 708                    | 105.67                  |
| 3-6         | 830    | 840                    | 101.20                  |
| 6-12        | 780    | 810                    | 103.84                  |
| 12-18       | 620    | 670                    | 108.06                  |
As can be seen from the above data, the average daily increase in live weight of experimental calves on a dairy farm in all age periods exceeded the calves of the experimental group. At birth and up to 3 months, the difference was 38 g or 5.67%. From 3 months of age, the difference was not significant - by 10 g or 1.2%. In the period from 6 to 12 months - 30 g or 3.84%. The largest average daily gain in live weight was observed between 12 and 18 months - 50 g, which is 8.06% in percentage terms.

The reproductive function of animals is closely related to the activity of the whole organism and, in turn, affects the metabolic processes, as a result, significant changes occur in the body of females at different periods of sexual function [10]. Table 4 shows data on the reproductive qualities of heifers.

**Table 4. Reproductive qualities of heifers.**

| Indicators                      | Group                  | Experienced to control |
|--------------------------------|------------------------|------------------------|
| Age of first insemination, months | 15 controls            | 14 experienced         | 107.1                  |
| Live weight at the first insemination, kg | 410.0 control         | 400.0 experienced    | 102.5                  |
| Fertility rate                  | 63.0 control           | 65.0 experienced       | +2.0 absolute %        |
| Insemination index              | 1.59 control           | 1.53 experienced       | +0.6 absolute %        |

From the data of table 4, it is seen that the age of the first insemination of heifers between the control and experimental groups had a difference of 1 month, which is 7.1% in percentage terms. The live weight at the first insemination between the studied groups is the difference of 10 kg or 2.5%. The fertility rate is +2.0 absolute percent. The insemination index is considered to be excellent and makes up the difference between the experimental groups of +0.6 absolute growth.

When calculating the economic indicators of using different reproduction methods for breeding Holstein cows, it turned out that during artificial insemination the number of inseminated heifers was 15 animals, they were inseminated 23 times; the cost of 1 dose of seed was 700.0 rubles, which was reflected in the cost: 16.1 thousand rubles were spent on the seed.

Since the calf yield in the analyzed farm was 65%, the number of calves born was 9 animals. In the studied economy, the prime cost of 1 kg of calf live weight was 200.0 rubles, which means that the average price of a calf was 10.0 thousand rubles. Hence, the cost of all calves was 72.0 thousand rubles. The profit received conditionally from the obtained calves amounted to 103.0 thousand rubles. When calculating the level of profitability, this indicator was equal to 7.9 percent.

With the introduction of the transplantation method of Holstein cattle embryos, the costs of the entire process in 2017 amounted to 187.0 thousand rubles. Fifteen embryos were introduced to the recipient cows, the survival rate of the embryos was 50.0%, which affected the output of newborn calves. This indicator amounted to 8 goals. The cost of embryo calves on the farm amounted to 24.1 thousand rubles, which is 2 times more than that obtained from artificial insemination. The cost of all calves was 192.8 thousand rubles. Contingent profit amounted to 267.8 thousand rubles. Profitability was 22.4 percent.

Thus, increasing the level of herd reproduction is a complex and multifaceted process, affecting various aspects of production activity.

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