Features of Reproduction of Dairy Cattle of the “Levochsky” Breeding Enterprise of the Novgorod Region

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Abstract. In modern conditions of intensification of dairy cattle breeding, it is necessary to increase or maintain at a certain level the livestock of cattle. With a general decrease in the indicators of the dairy cattle breeding industry in the region under study, it is necessary to search for ways and methods of organizing production that would improve the efficiency of the manufactured products. As an example, the results of the work of a breeding farm are offered, which successfully solves the problems facing it in the reproduction of the breeding stock and receives seven thousandth milk yield with a high content of mass fraction of fat in milk from farmed cows. In the course of the research, the features of herd reproduction in the breeding reproducer of Ayrshir cattle of the agricultural production cooperative “Levochsky” in the Novgorod region were studied.

The article presents tabular data with the main indicators of reproduction of the studied breeding reproducer and an analysis of these data. The conducted research shows that the breeding reproducer of the agricultural production cooperative “Levochsky” successfully solves the issues of reproduction of its dairy herd applying modern methods and technologies of livestock breeding. But for a stable position of the enterprise as a breeding farm, it is necessary to increase the output of calves per hundred cows to at least 85%. In the course of research, the authors found that in order to achieve real success in dairy production, it is necessary to engage not only in reproduction, but also in selection and breeding work in general. Based on the studies carried out, well-grounded conclusions were made about the need to further increase the efficiency of work on the reproduction of the breeding stock of the studied breeding reproducer.

1. Introduction

The Ayrshire cattle breed is considered one of the world's best dairy cattle breeds and has an extensive distribution area. Ayrshire cattle are early maturing breeds and cows reach the highest productivity by the 3rd – 4th lactation. Good feeding and keeping of animals contribute to the early onset of maximum productivity and a smoother decline. The Ayrshire breed of cattle, as a planned breed, before the fundamental transformations in our country, accounted for about 45% of the dairy cattle in the Novgorod region, providing a significant share of milk and meat produced in the region. More than a tenfold decline in the number of dairy cattle breeding stock and the expansion of the Holstein breed have led, in recent decades, to a decrease in the share of Ayrshire cattle in the region to 30–35%. The coverage of artificial insemination of dairy farms in the region decreased from 85 to 71%. In those farms where artificial insemination is ignored, there is a catastrophic decline in livestock (37% over 3 years) and a 44% drop in milk production.

According to a number of researchers, the transfer of dairy cattle to intensive technologies has a negative impact on the ability of the broodstock to produce offspring. As a result, the period of economic use of cows, the yield of young animals decreased, and other problems with the reproduction of the dairy herd arose [1, 2].

The difficult current situation of dairy cattle breeding requires the search for ways to organize production that will increase its efficiency. The most important task is to work on improving the breeding and productive qualities of the broodstock, the development of pedigree cattle breeding in general, in order to increase the level of the competitive domestic breeding base and ensure the acquisition of commercial enterprises with highly productive young animals [3].
To accelerate the development of the dairy industry, many scientists are improving the breeding process, searching for new methods of adapting animals to the introduced elements of industrial technology. [4, 5, 6, 7]. Intensive rearing of replacement heifers is one of the main ways to create a highly productive herd. Only developed and strong animals can provide the farm with high milk productivity [8]. Herds with milk yields of 4-5 thousand kg of milk per lactation, which were recently considered highly productive, are currently of little prospect. It is necessary to create dairy herds with milk yields of 7 thousand kg of milk per lactation and above.

The dairy herd of one of such enterprises of the agricultural production cooperative "Levochsky", a pedigree reproducer of Ayrshire cattle, is the object of our research.

2. Objects and research methods
Our objective is to consider the current state of the issues of reproduction of dairy cattle in the agricultural production cooperative "Levochsky", to study the measures carried out in the breeding reproducer to intensify the rearing of replacement heifers, the peculiarities of rearing replacement heifers, the main indicators of the reproduction of dairy cattle for the period under study. The analysis of methods for increasing the reproductive capacity of cows is carried out. The studies were carried out in the period from 2016 to 2020. When analyzing the results, the data of primary zootechnical, pedigree registration and grading of livestock were studied.

3. Results and discussions
Analyzing the production indicators of this farm (table 1), attention should be paid to the stable simple reproduction of the broodstock. With an annual increase in the milk productivity of the herd, the average milk yield from a cow in 2020 was 7125 kg with a fat mass fraction of 3.99%, and a protein mass fraction of 3.28%, exceeding the indicators of 2016 for milk yield by 235 kg.

| Year | Number of cows | Milk yield per 305 days, kg | Fat mass fraction, % | Protein mass fraction, % | Profitability of dairy farming, % |
|------|----------------|-----------------------------|----------------------|--------------------------|----------------------------------|
| 2016 | 410            | 6890                        | 4.29                 | 3.12                     | +17                              |
| 2017 | 410            | 6928                        | 4.23                 | 3.46                     | +12                              |
| 2018 | 410            | 6895                        | 4.19                 | 3.34                     | +10                              |
| 2019 | 410            | 7062                        | 4.07                 | 3.27                     | +5                               |
| 2020 | 410            | 7125                        | 3.99                 | 3.28                     | +5                               |

It should be noted that during the studied period there was a significant decrease in the mass fraction of fat in the milk of cows (by 0.3%) and in the last studied period this indicator dropped below four percent, which is not typical for the Ayrshire breed with a high fat content. Consequently, increasing the mass fraction of fat in milk of cows is one of the priority tasks for breeders of this breeding enterprise, associated primarily with the quality of selection and selection of animals.

The profitability of dairy cattle breeding during the studied period decreased from 17 to 5%, while the profitability from the sale of the main product of the breeding economy - pedigree young stock increased.

In the practice of dairy cattle breeding, an indicator of the development of a heifer is the achievement of seventy percent of the live weight of an adult animal. At the same time, it is desirable to reduce the rearing period by reducing the cost of rearing replacement heifers. After this period, it can be inseminated without creating problems for health and future productivity. Consequently, intensive rearing of replacement young stock is one of the factors in creating a highly productive dairy herd.

Adequate feeding will allow heifers to develop faster and develop accordingly at an earlier age. Late insemination leads to unnecessary feed costs and a decrease in the efficiency of its use.

Born heifers of the studied breeding reproducer are raised according to the Krasnodar technology, the essence of which is as follows: the calf from birth during the first 2 days is kept in wooden cages under an infrared lamp with colostrum drinking, according to a scheme consisting of 5 periods, through a drencher. Then in individual cages up to 100 days of age using starter feed and whole corn. The ratio of starter feed and whole corn from 3 to 30 days is fifty to fifty percent. And from 31 days to 100 days, 30% of starter feed pellets and 70% of whole corn are used. Then, heifers are transferred to group cages before the first insemination.
Analysis of indicators of the development of replacement young animals on the farm (Table 2) shows that heifers are reared intensively, consequently, the average age of the first insemination in the last three years has decreased to 16 months.

**Table 2. Characteristics of rearing heifers (according to grading data).**

| Year | Age of heifers, months | 1<sup>st</sup> insemination |
|------|------------------------|-----------------------------|
|      | number, heads          | live weight, kg              | number, heads          | live weight, kg              | number, heads          | live weight, kg              |
| 2016 | 25                     | 230                          | 128                     | 274                          | 108                     | 394                          | 16                     | 355                          |
| 2017 | 27                     | 244                          | 121                     | 285                          | 138                     | 380                          | 17                     | 364                          |
| 2018 | 33                     | 234                          | 111                     | 283                          | 111                     | 385                          | 18                     | 368                          |
| 2019 | 33                     | 243                          | 107                     | 285                          | 113                     | 399                          | 17                     | 370                          |
| 2020 | 21                     | 251                          | 114                     | 296                          | 124                     | 401                          | 16                     | 367                          |

Early achievement of the breeding body weight of animals reduces the age of first insemination, and, consequently, the beginning of the first lactation.

With late insemination, feed is consumed unnecessarily and less milk and offspring are obtained. With full and abundant feeding, heifers develop rapidly, which allows them to be inseminated at an earlier age.

In the studied breeding reproducer, the live weight during the first insemination varied within 355 ... 370 kg. That exceeds the indicators of many similar farms. The greatest increase in live weight over the past five years is observed at the age of 10 months (+ 21 kg) and 12 months (+ 22 kg).

At the same time, a similar trend is observed in all studied periods: heifers gain the greatest gains up to 12 months (at least half of the body weight of an adult animal).

Analysis of indicators of reproduction of dairy cattle on the farm (Table 3) shows that with the calf yield of 82 ... 83%, the annual input of first-calf heifers into the broodstock is 26.0 ... 29.3 heads, and part of replacement heifers is sold. Consequently, an increase in the yield of calves will increase the efficiency of the enterprise as a breeding reproducer allowing to increase the sale of breeding young.

The average age of disposed cows is quite high and for the analyzed 5 years it varied from 3.8 to 4.2 calvings and in 2020 was 4.0 calvings.

**Table 3. The main indicators of reproduction of dairy cattle for the period under study.**

| Year | Calf yield, % | First heifers input, % | Service period, days | Dry period, days | Average age, calvings | Average age of disposal, calvings | The number of inseminations per fruitful |
|------|--------------|------------------------|----------------------|-----------------|-----------------------|-----------------------------------|----------------------------------------|
| 2016 | 82           | 26.0                   | 114                  | 60              | 2.9                   | 3.8                               | 2.3                                    |
| 2017 | 82           | 28.3                   | 106                  | 55              | 2.7                   | 4.2                               | 2.1                                    |
| 2018 | 83           | 29.3                   | 107                  | 55              | 2.7                   | 3.8                               | 2.1                                    |
| 2019 | 83           | 27.8                   | 107                  | 55              | 2.7                   | 3.8                               | 2.0                                    |
| 2020 | 83           | 27.3                   | 115                  | 55              | 2.7                   | 4.0                               | 2.0                                    |

The reasons why the majority of cows dropped out are gynecology and barrenness (more than 30%), then diseases of the udder (10 ... 31%) and limbs (from 1 to 24%). The ranking for low productivity is from 2 to 31% (table 4). It should be noted that the selection of dairy cattle in terms of productivity has increased significantly in recent years.
Table 4. Disposal of cows and heifers.

| Year | Disposed in total, heads | Disposed in low productivity | Reasons for disposal | Diseases |
|------|--------------------------|-------------------------------|----------------------|----------|
|      |                          |                               |                      | gynecological and barrenness | udder | limbs | traumas | other |
| 2016 | 119                      | 2                             | 31                   | 28       | 1     | 2     | 55      |
| 2017 | 116                      | 13                            | 32                   | 24       | 9     | 1     | 37      |
| 2018 | 125                      | 29                            | 31                   | 31       | 14    | 1     | 19      |
| 2019 | 114                      | 29                            | 33                   | 15       | 15    | 5     | 17      |
| 2020 | 108                      | 31                            | 29                   | 10       | 24    | 4     | 10      |

The time interval from calving of a cow to its fruitful insemination is called the service period. It is an indicator that allows you to identify the potential of the reproductive function of a cow. In developed countries, the average duration of the service period usually exceeds one hundred days.

Research by scientists shows that cows are fertilized only after the end of the involution of the uterus. Therefore, they should be inseminated during this period.

According to a number of researchers [9, 10], the involution of the uterus after a normally passed calving in most cows ends within 30 ... 50 days and is delayed after dysfunctional calving, violations of feeding and keeping animals. Therefore, complete feeding of cows is crucial to meet the timing of their subsequent insemination. Monitoring the duration of the service period allows you to daily assess the situation in the herd, regulate the timing of insemination of animals, and increase the fertility of cows [11].

The length of the service period also depends on the length of time between re-inseminations. It is advisable to inseminate at least ninety percent of cows within three months after calving.

This indicator in the farm is 106 ... 115 days, indicating the optimization of the timing of insemination of cows after calving, as well as the number of inseminations per one fruitful decreased to 2.0 times. It should be noted that in countries with developed dairy farming, the average duration of the service period also slightly exceeds 100 days.

Another segment of the life of the broodstock is the dry period - one of the crucial moments in the technology of dairy cattle breeding, when reserves of nutrients are created to prepare for a successful calving [12]. The optimal value for this indicator is considered to be 50 ... 60 days and a deviation in any direction can have negative consequences.

The analysis showed that over the past four years, the average length of the dry period is maintained on the farm strictly 55 days. However, within the herd, there were significant fluctuations in the duration of this period for individual cows. It should be noted that cows with both short and longer dry periods had the lowest milk yield. Taking into account the annual high introduction of first-calf heifers into the herd, the average age of the broodstock is 2.7 calvings.

In this paper, mainly issues related to the reproduction of dairy cattle in the best breeding farm of the region, which breeds the Ayrshire cattle breed, were considered. At the same time, it should be noted that, according to a number of research authors, in many enterprises it is necessary to improve not only individual details of the production process (reproduction), but in general, selection and breeding work and its results. And the most important breeding characteristics are milk yield, the mass fraction of fat and protein in milk and the live weight of the animal [13, 14].

The following indicators for all categories of farms should become guidelines for improving work on the reproduction of a dairy herd: calf yield per 100 cows, 85–95%, interbody period, 12–13 months, service period, 60–110 days, insemination index 1.8, average age of the 1st insemination 24–27 months, average period of economic use of cows 5 calving.

4. Conclusion
1 The pedigree reproducer of the agricultural production cooperative “Levochsky” successfully solves the issues of reproduction of its dairy herd applying modern methods and technologies of cattle breeding.
2 For a stable position of the enterprise as a breeding farm, it is necessary to increase the output of calves per hundred cows to at least 85%.
3 We consider it expedient to develop measures on the farm to increase the content of fat mass fraction in milk of cows to values that are more typical for the Ayrshire breed.
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