

Conference Paper

Selection and Breeding of Dairy Cattle in Western Siberia

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Abstract

The main objective of stock breeding is to raise highly productive animals, improve existing ones and create new types and breeds of livestock. The main focus of dairy cattle breeding is on increasing milk yield, fat and protein content in milk; preserving fertility and productive longevity; and developing high adaptive properties of suitability for modern industrial technologies. Selection and breeding of black-and-white and red steppe breeds of cattle is aimed at improving the breeding and productive qualities of the animals. These breeds are traditionally raised in Western Siberia. Breeding to improve the economic and productive features of black-and-white and red steppe breeds of cattle led to the creation of new zonal types, including the Priobsky, Kulunda and Siberian zonal types, which are characterized by relatively high dairy productivity. This study showed that the Siberian type of heifers had the maximum milk yield – 6389 kg, which was 1239 kg and 828 kg more than the Kulunda and Priobsky types, respectively. The same tendency was observed for the third lactation. Animals with a dry period of less than 40 days had lower milk yields than those with a longer period. In terms of the amount of milk and the weight fraction of fat and protein in the milk, the animals exceeded the standard for the parental breed. The duration of pregnancy among the studied animals was within the physiological norm – 276.1-280.8 days. The research results may be of interest to agricultural students and specialists involved in selection issues.

Keywords: reproduction, breed, milk productivity

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1. Introduction

Cattle breeding includes organizational and zootechnical measures aimed at improving the economic and useful qualities of animals. This is both the productivity increase and the increase of the breeding value of animals, as well as the rational use of breeding animals.

The main objective of breeding is to raise highly productive animals, systematically improve existing ones and raise new breeds and types. The animals should have high

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suitability for use in modern high-tech conditions. To do this, experts select according to a number of selection features: level of productivity, quality of products, rate of milk production, udder shape, resistance to diseases, etc.

The Siberian region is one of the largest agricultural regions and an important regulator of the production market (Kosenchuk, Shumakova, 2019). The most common breeds of dairy cattle here are black-and-white and red steppe breeds, which are well adapted to the climate of Western Siberia (Ovcharenko, Kharina, 2019).

The black-and-white breed is characterized by high milk productivity. The average milk yield per cow is 4,000-6,000 kg of milk with fat content of 3.6-3.7%. The body weight of cows is 550-650 kg, bulls – 900-1000 kg. At the age of 15-16 months, the body weight reaches 420-480 kg. The weight of calves at birth is 35-40 kg. The average daily increase of the body weight is 600-800 g, and with intensive feeding – 800-1000 g.

The red steppe breed has been raised from the end of the 18th century, and was registered in 1923. The body weight of cows is on average 450 kg, stud bulls – up to 900 kg, the average daily increase with optimal feeding and management conditions is 700 grams. The average yield is 3500-4000 kg with a fat content of 3.6-3.7%, in breeding farms – 4500-6000 kg. The animals have good responsiveness to improve the management and feeding conditions. The peculiarity of the breed is high adaptation to any climatic conditions, they also have strong immunity, high endurance and unpretentiousness of management. Some species have a number of disadvantages: poor muscles, low body weight, appearance defects (Kharina, 2017).

2. Problem Statement

The issues of dairy cattle selection and breeding are covered in the scientific works (Rudishina et al., 2006, 2007, 2013, 2015), (Korsheva et al., 2018), (Chaunina E. et al., 2020), (Hagan B.A. et al., 2020), (Bagirov V.A. et al., 2009), (Kalashnikov A.P. et al., 1992), (Kosarev A.P. et al., 2014), (Russkikh T.A. et al., 2017), (Simanovich O.V. et al., 2009) and other researchers.

To improve the black-and-white and red steppe breeds, the selection is aimed at increasing milk productivity, fat and protein content in milk, improving the body strength, type of nervous activity and industrial suitability.

Taking into account the natural and climatic conditions, new breed types were created: Priobsky black-and-white and Kulunda and Siberian red steppe breeds.

The Priobsky black-and-white cattle was created using reproductive crossing of black-and-white heifers with the stud bulls of the Holstein breed. The animals of a new type are better adapted for industrial conditions, are characterized by a relatively high milk productivity – 4500-7500 kg of milk with a fat content of 3.87%, protein – 3.10%. The Priobsky type was registered in 2005.

The improvement of the red steppe cattle in the Altai Territory led to the creation of the Kulunda breed, approved in 2005. The breeding of this type of animals is carried out in the farms of the Altai Territory and Omsk Region. The animals of the new type are characterized by an elongated well-developed body, cup- and bath-shaped udder, increase of milk yield, fat and protein content, as well as the body weight with high adaptability to the local climate. By milk yield of cows on average for the third lactation is 4800-5500 kg, fat content – 4.10-4.25%, protein – 3.20-3.30%.

The crossing of red steppe cows with Holstein red-and-white bulls significantly improved the milkability of cows, the quality of udder, and the adaptability to industrial technologies. Hence, a peculiar population of dairy cattle was formed, breeding of which led to the creation of a new type of red steppe cattle – Siberian, which was approved in 2003. The average milk yield of Siberian cows is 5700 kg, the fat content is 3.75%, the body weight of an adult cow is 550-600 kg.

The subject of the scientific article are Priobsky black-and-white cows, Kulunda and Siberian red steppe cows.

The purpose of the study is to assess the economic and useful features of zonal types of dairy cattle in Western Siberia.

3. Materials and Methods

The analysis of milk production was carried out according to daily milk yield of the first three lactations (average milk yield per forage-fed cow, kg), fat content (%) and amount of milk fat (kg). Data on the duration of calving interval, dry and service periods, which are the main indicators of reproduction, are used to characterize the reproductive qualities. These indicators are taken into account during selection.

4. Findings

Table 1 shows the summary figures of milk productivity of zonal cows according to breeding farms.

The comparison of the main indicators of productivity of Priobsky cows with the breed standard showed that these animals exceed the black-and-white standard for Siberia and the Urals.

The milk yield of Priobsky cows for 1, 2 and 3 lactations is less than the indicators of the standard black-and-white cows by 122%, 84% and 66%, respectively. The reason for higher productivity of Priobsky cows is that it was created using highly productive stud bulls of Holstein breed, which is the leader in milk productivity. In terms of the fat content in milk, the superiority of Priobsky animals makes 0.51%.

TABLE 1: Milk productivity of zonal cows

Indicator	Priobsky	Kulunda	Siberian
Milk yield for 1st lactation, kg	5561 ± 52.5	5150 ± 33.6	5150 ± 33.6
Milk yield for 2nd lactation, kg	5621 ± 56.6	5463 ± 38.7	5463 ± 38.7
Milk yield for 3rd lactation, kg	5638 ± 56.5	5610 ± 40.9	5610 ± 40.9
Fat content in milk, %	4.11 ± 0.01	3.96 ± 0.01	3.96 ± 0.01
Milk fat for 1st lactation, kg	228 ± 2.5	203 ± 0.01	203 ± 0.01
Milk fat for 2nd lactation, kg	230 ± 2.4	219 ± 1.4	219 ± 1.4
Milk fat for 3rd lactation, kg	233 ± 2.4	219 ± 1.6	219 ± 1.6

Kulunda and Siberian cows exceed the standard milk yield of the red steppe breed at a rate of 1-3 lactations by 115%, 92% and 75%, respectively. The fat content in the milk of Kulunda and Siberian cows was 3.96% and 3.81%, which is 0.26% and 0.11% higher than the standard red steppe breed, respectively. When creating these zonal types, one of the objectives was to increase the fat content in milk, which was fulfilled, as confirmed by the above data. The content of milk fat as a whole naturally increases with the increase in the fat content in milk. The deviation from the standard in favor of the animals of the study groups in terms of the amount of milk fat for 1-3 lactations was: Kulunda – by 163%, 152% and 134%, Siberian – by 234%, 265% and 276%, respectively.

Along with milk yield increase, the important role in dairy cattle selection and breeding is given to the improvement of the reproductive function of animals. Increasing the level of reproduction of animals is of great practical and scientific interest, especially for the animals of new genotypes, since the disruption of these functions leads to a reduction in the length of economic use of animals and a decrease in the level of milk productivity, which will negatively affect the industry profitability. The duration of service and dry periods gives a certain idea on the reproducibility of animals.

The service period is one of the indicators of reproduction efficiency. After calving, the female cow should restore the functions of reproductive organs and prepare for fertilization. Therefore, a very short and unreasonably long service period is undesirable.

In some farms, in order to increase the milk production per lactation, the service period is deliberately increased, which leads to an extension of lactation and calving intervals, thereby contributing to an increase of the milk yield both over 305 days and over the total lactation, but leading to a decrease in the milk yield per day.

TABLE 2: Duration of pregnancy and service period

Lactation	Service period, days	Pregnancy, days
Priobsky		
First	174.0 ± 7.93	277.5 ± 7.92
Second	171.1 ± 7.63	276.1 ± 7.56
Kulunda		
First	131.3 ± 3.91	280.8 ± 3.97
Second	119.7 ± 4.34	280.3 ± 4.36
Siberian		
First	149.7 ± 4.98	277.8 ± 4.98
Second	152.9 ± 4.97	277.1 ± 4.99

The analysis of Table 2 makes it possible to conclude that the shortest service period is typical for Kulunda cows, which duration is 131.3 and 119.7 days for the first and second lactation, respectively. As for Priobsky cows, this indicator was more by 43.3 and 50.8 days (32.5 and 42.9%), Siberian cows – by 18.4 and 32.6 days (14.0 and 27.7%), respectively.

The shortest pregnancy period was observed among Priobsky and Siberian cows: within 277.5-277.8 days for the first lactation and 276.1-277.1 days for the second lactation. The pregnancy period of Kulunda cows lasted 3 days more.

A dry period is physiologically necessary to preserve the health of animals, extend their lifespan, obtain viable animal yield and high milk productivity of cows. During this period the body weight of cows is compensated, which often decreases during lactation, and the udder functional abilities are also restored. The average duration of the dry period for strong normally fed cows is 60 days. If the duration of the dry period is not within the range of 45 to 75 days, then this will negatively affect both the health of a calf and a cow itself. The cows may have post-parturient complications, which will negatively affect its productivity and reproductive function.

The dependence of the level of milk productivity on the duration of the dry period was analyzed (Table 3).

With the dry period of less than 40 days, the milk yield of Priobsky cows was 6250 kg, which is 790 kg and 975 kg less than in the groups where the duration of this period is 40-60 days and more than 60 days, respectively. According to the fat content in milk,

TABLE 3: Milk productivity of cows depending on the duration of the dry period

Indicator	Duration of the dry period, days		
	less than 40	40-60	more than 60
Priobsky			
Milk yield, kg	6250 ± 596	7040 ± 107	7225 ± 143
Fat content in milk, %	3.95 ± 0.08	3.92 ± 0.02	3.90 ± 0.02
Milk fat, kg	247 ± 22	276 ± 4	282 ± 5
Kulunda			
Milk yield, kg	4972 ± 213	5689 ± 63	5598 ± 54
Fat content in milk, %	4.02 ± 0.04	3.83 ± 0.03	3.98 ± 0.02
Milk fat, kg	200 ± 9	217 ± 3	222 ± 2
Siberian			
Milk yield, kg	5512 ± 205	5699 ± 65	5471 ± 140
Fat content in milk, %	4.14 ± 0.04	4.13 ± 0.01	4.12 ± 0.02
Milk fat, kg	228 ± 9.0	235 ± 3.0	225 ± 6.0

the cows with the duration of the period less than 40 days have the largest indicator – 3.95%, which is 0.03% and 05% more than their herdmates. The amount of milk fat is higher in the group of cows, which dry period is more than 60 days. This is usually caused by the fact that highly productive cows are more difficult to dry off. The Kulunda as well as Priobsky cows had a minimum milk yield with a dry period of less than 40 days. The milk yield of Siberian cows within the duration of the dry period was slightly different.

5. Conclusion

Thus, in a relatively short time, new zonal animal types were created that exceed the standards of initial breeds in terms of dairy productivity. Subject to good conditions of animal feeding and management, further selection and breeding will reduce the service period to the optimal duration, which will positively affect the productivity and reproduction of animals.

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