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The Effectiveness of Admixture and Backcrossing in the Creation of the Modernized Type of Simmenthal Cows

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Abstract.
Since the 90s of the 20th century and up to the present time, backcrossing with purebred Simmenthal bulls has been carried out for the most of the crossbred Simmenthal-Holstein livestock. At the current stage, such an understanding in the breeding of the Simmenthal breed corresponds to the breeding task set - to move from the old type of Simmenthals to the new improved type of Simmenthals through the admixture with the Holsteins. The animals themselves and the data of the primary zootechnical record have served as the material for the research. The animal groups for comparative assessment were formed according to the principle of analogue pairs based on the age, dams' and live weight productivity as per the zootechnic experiments' methodology. The groups were composed of the purebred Simmenthals and the animals obtained as a result of the admixture (1/2 blooded in the red-and-white Holstein breed - RWH) and backcrossings (1/4 and 1/8 blooded on the RWH) crossings. The results showed that crossbreds had better fertility compared to purebred analogues.

Keywords: crossing, milk yield, reproductivity, Simmenthal breed.

INTRODUCTION

The issue of provision of natural domestically-made dairy products to the Russian population is prevalent since over the years of agricultural reforms the dairy cattle breeding has suffered significant losses. During this period, gross production of milk decreased from 55.7 million tons to 30.0 million tons, including marketable milk of about 21.0 million tons.

Scientific studies have shown that in the intensive milk production it is necessary to keep cows of a more progressive type. Academician L.K Ernst notes that these animals are characterized by high dairy productivity, good reproductivity, they are suitable to machine milking, have durable hoof horn, resistant to diseases and, above all, to mastitis [1].

Therefore, in order to further increase the gross production of milk, the completion a herd with highly productive and competitive cows resulting from the targeted stock breeding has an important role.

The modern Simmenthal breed cattle is characterized by a great genetic and phenotypic variety, which allows the breeding of Simmenthal cattle both in the dairy and in the meat area [2, 3]. The purebreeding and crossing are the main methods for improving the Simmenthal breed. Both of these methods are not mutually exclusive, but mutually complementary and conditioning [4]. The crossing, as a method of breeding, can dramatically intensify the breeding process to achieve the desired results in the 2-3 generations [4]. The criterion for assessing all crossing work is not the high "blood share" of the improving breed in the crossbreds, but the desired productivity, the desired type of livestock, and the high breeding quality of the obtained animals [2, 5].

Since the 90s of the 20th century and up to the present time, backcrossing with purebred Simmenthal bulls has been carried out for the most of the crossbred Simmenthal-Holstein livestock. At the current stage, such an understanding in the breeding of the Simmenthal breed corresponds to the breeding task set - to move from the old type of Simmenthals to the new improved type of Simmenthals through the admixture with the Holsteins [5, 6]. Holsteinization of Simmenthal cattle in the Russian Federation has yielded mixed results depending on a number of factors, one of which is the blood relationship by the improving red-and-white Holstein breed [4]. It has been established that increasing the blood relationship of the Holstein breed results in animals that are more demanding of the conditions of feeding and maintenance, capable of high milk productivity in farms with a solid fodder base. However, in the context of unstable and unbalanced feeding, they are worse than the improved source breed [3]. Each region of the Russian Federation should address a specific issue - to what pedigree level the animals should be backcrossed and how to support the process since the information obtained on the optimal genotypes for improving Simmenthals is contradictory.

Therefore, research on the identification of a competitive genotype of Simmenthal cattle, including the improved one by admixture of blood the of red-and-white Holstein breed, is relevant.

MATERIALS AND METHODS

The research was carried out at the Komsomolets instructional-and-breeding farm of the Tambov region. The farm is characterized by a high level of zootechnical work and well-adjusted breeding records.

The animals themselves and the data of the primary zootechnical record have served as the material for the research. The animal groups for comparative assessment were formed according to the principle of analogue pairs based on the age, dams' and live weight productivity as per the zootechnic experiments methodology. The groups were composed of the purebred Simmenthals and the animals obtained as a result of the admixture (1/2 blooded in the red-and-white Holstein breed - RWH) and backcrossings (1/4 and 1/8 blooded on the RWH) crossings.

The basic background on which a comparative assessment of the purebred and holsteinized Simmenthal cows was made based on the duration of economic use was the same conditions of keeping, feeding and maintenance. This contributed to more complete manifestation of the genetic features of experimental animals.

RESULTS

The milk productivity of cows is a fundamental indicator of the economic and biological properties of dairy cattle. Therefore, the study as well as the identification of the most promising genotypes in the Simmenthal cattle herd were started with the investigation of this indicator.

Table 1 provides data on milk productivity of the holsteinized (1/2RWH blooded) and purebred Simmenthal cows by the first three lactations. It has been revealed that by the duration of lactation the holsteinized (1/2RWH blooded) Simmenthal cows had an advantage over purebred herdmates on the first lactation by 1.8 days, for the second lactation - by 14.8 days, and for the third - by 5.5 days. It should be noted that this difference had proved to be statistically unreliable. By the size of the milk yield the holsteinized Simmenthals outnumbered purebred herdmates in the section of lactations: by 82.5 kg, 543.9 kg ($P>0.95$), and 89.2 kg, by the yield of milk fat by 3.3 kg, 17.6 kg ($P>0.95$), and 2.9 kg.

By the fat content in milk, the crossbred animals had indicators slightly below purebred herdmates (0.01%). It should be noted that with advancing age, the fat content in milk of the animals of the compared groups remained at the same level. The Simmenthal livestock is characterized by a virtually constant content of fat in milk throughout life, which is confirmed by studies of the majority of scientists [2, 5, 7].

By the quantity of milk with 4% fat content, the holsteinized Simmenthals outnumbered their purebred analogues in the first three lactations by 82 kg, 516.3 kg (P>0.95), and 87.8 kg, respectively.

The results of a comparative analysis of milk productivity in purebred and 1/4RWH blooded of animals showed that there were certain intergroup differences in the duration of lactation (Table 2). Thus, holsteinized (1/4RWH blooded) heifers had 5.4 days less lactation than their purebred herdmates. But in the second and third lactations, longer lactations were found in crossbred animals - by 11.2 and 19.9 days, respectively. In terms of the milk yield for the first lactation, the pure-bred Simmenthal herdmates had an advantage over the crossbred ones by 217.8 kg of natural fat milk. On the second and third lactations, the differences between the compared groups were in favor of holsteinized Simmenthals by 295.8 and 329.9 kg, respectively, but the difference in all cases has proved to be statistically unreliable. By the yield of milk fat for the first lactation, the difference was in favor of purebred herdmates and was 6.4 kg, and for the second and third lactations - in favor of the crossbred - by 11.8 and 15.9 kg, respectively.

Table 1 - Milk productivity of the purebred and holsteinized (1/2RWH blooded) Simmenthal cows

Lactation	Group of animals	n	Milk productivity								
			per lactation					per 305 days of lactation			
			Q-ty of milking days	milk yield, kg	fat, %	amount of fat, kg	milk yield of 4% milk, kg	milk yield, kg	fat, %	amount of fat, kg	milk yield of 4% milk, kg
1	C	25	285.1± 6.11	3,618.4± 133.9	3.76± 0.01	136.0± 5.1	3,487.8± 130.6	3,586.7± 126.4	3.76± 0.01	135.3± 4.9	3,460.7± 132.2
	1/2 RWH blooded	25	286.9 ±7.19	3700.9 ±131.7	3.76 ±0.02	139.3 ±5.0	3569.8 ±127.9	3,651.3 ±120.1	3.77 ±0.02	137.7 ±4.7	3,526.3 ±118.1
	C ± to 1/2 RWH blooded		-1.8	-82.5	0	-3.3	-82.0	-64.6	-0.01	-2.4	-65.6
2	C	25	293.1 ±7.7	4,154.7 ±140.5	3.76 ±0.01	156.1 ±5.1	4,003.0 ±132.4	4,087.2 ±129.8	3.77 ±0.01	153.8 ±4.8	3,942.4 ±123.5
	1/2 RWH blooded	25	307.9 ±8.9	4,698.6 ±170.5	3.75 ±0.01	173.7 ±6.8	4,519.3 ±162.6	4,572.0 ±162.8	3.75 ±0.01	169.4 ±6.6	4,402.9 ±156.6
	/2 RWH blooded		-14.8	-543.9*	+0.01	-17.6*	-516.3*	-484.8*	+0.02	-15.6*	-460.5*
3	C	25	299.7 ±8.3	4912.1 ±167.6	3.76 ±0.01	184.9 ±6.5	4735.3 ±163.4	4793.2 ±150.5	3.78 ±0.01	180.9 ±5.8	4631.1 ±146.6
	1/2 RWH blooded	25	305.2 ±6.6	5001.3 ±251.4	3.75 ±0.01	187.8 ±9.6	4823.1 ±243.1	4847.3 ±216.5	3.75 ±0.01	182.3 ±8.4	4680.2 ±212.1
	C ± to 1/2 RWH blooded		-5.5	-89.2	+0.01	-2.9	-87.8	-54.1	+0.03	-1.4	-49.1

Note: *P>0.95

Table 2 - Milk productivity of the purebred and holsteinized (1/4RWH blooded) Simmenthal cows

Lactation	Group of animals	n	Milk productivity								
			per lactation					per 305 days of lactation			
			No. of milking days	milk yield, kg	fat, %	amount of fat, kg	milk yield of 4% milk, kg	milk yield, kg	fat, %	amount of fat, kg	yield of 4 % milk, kg
1	C	25	301.8 ±13.7	3,883.6 ±205.0	3.71 ±0.02	144.2 ±7.6	3,716.9 ±196.4	3,694.8 ±154.9	3.69 ±0.02	136.6 ±5.8	3,526.2 ±148.1
	1/4 RWH blooded	25	296.4 ±12.9	3,665.8 ±198.9	3.76 ±0.01	137.8 ±7.6	3,533.8 ±192.7	3,534.4 ±164.6	3.75 ±0.01	132.4 ±6.1	3,399.5 ±156.7
	C ± to 1/4 RWH blooded		+5.4	+217.8	-0.05*	+6.4	+183.1	+160.5	-0.06**	+4.2	+126.7
2	C	25	300.6 ±16.3	4,317.0 ±274.2	3.74 ±0.02	160.7 ±10.7	4,156.1 ±269.0	4,055.8 ±189.4	3.74 ±0.01	150.3 ±7.1	3,896.2 ±181.7
	1/2 RWH blooded	25	311.8 ±12.6	4,612.8 ±250.3	3.73 ±0.01	172.5 ±9.6	4,432.7 ±242.6	4,373.1 ±206.4	3.72 ±0.01	162.9 ±7.7	4,192.9 ±198.5
	C ± to 1/4 RWH blooded		-11.2	-295.8	+0.01	-11.8	-276.6	-317.3	+0.02	-12.6	-296.7
3	C	20	308.3 ±18.5	4,869.6 ±376.2	3.74 ±0.02	182.4 ±14.9	4,687.6 ±373.3	4,593.7 ±219.7	3.73 ±0.02	171.5 ±8.6	4,410.3 ±216.6
	1/2 RWH blooded	22	328.2 ±22.6	5,199.5 ±435.6	3.79 ±0.02	198.3 ±17.2	5,054.0 ±432.1	4,719.1 ±327.5	3.77 ±0.02	178.9 ±12.9	4,570.7 ±325.2
	C ± to 1/4 RWH blooded		-19.9	-329.9	-0.05	-15.9	-366.4	-125.4	-0.04	-7.4	-160.4

Note *P>0.95, **P>0.99

Table 3 - Milk productivity of the purebred and holsteinized (1/8 RWH blooded) Simmenthal cows

Lactation	Group of animals	n	Milk productivity								
			per lactation					per 305 days of lactation			
			No. of days	milk yield, kg	fat, %	amount of fat, kg	milk yield of 4% milk, kg	milk yield, kg	fat, %	amount of fat, kg	milk yield of 4% milk, kg
1	C	27	311.1 ±19.3	3,825.1 ±246.2	3.76 ±0.02	144.9 ±9.8	3,703.2 ±244.7	3,422.2 ±173.9	3.75 ±0.03	131.8 ±7.5	3,304.7 ±172.4
	1/8 RWH blooded	27	335.5 ±14.6	4,395.7 ±206.2	3.76 ±0.01	165.2 ±7.7	4,273.8 ±203.1	3,988.8 ±161.2	3.74 ±0.01	149.2 ±5.9	3,833.9 147.8
	C ± to 1/8 RWH blooded		-24.4	-570.6	0	-20.3	-570.6	-566.6*	+0.01	-17.4	-529.2*
2	C	25	314.1 ±11.2	4,151.8 ±175.9	3.84 ±0.01	159.3 ±6.8	4,050.8 ±172.6	3,933.8 ±145.9	3.83 ±0.01	153.4 ±6.2	3,834.6 ±145.5
	1/8RWH blooded	27	321.9 ±9.5	4,871.7 ±178.5	3.79 ±0.01	184.9 ±6.6	4,722.2 ±169.9	4,611.2 ±150.2	3.78 ±0.02	174.4 ±5.5	4,460.9 ±142.0
	C ± to 1/8 RWH blooded		-7.8	-719.9**	+0.05**	-25.6**	-671.4**	-677.4**	+0.05**	-21.0**	-626.3**
3	C	25	287.5 ±15.8	4,373.8 ±264.4	3.83 ±0.02	167.9 ±10.5	4,280.9 ±257.7	4,139.5 ±198.6	3.82 ±0.02	158.8 ±7.9	3,977.7 ±186.1
	1/8 RWH blooded	26	312.5 ±10.4	5,031.3 ±193.8	3.79 ±0.01	190.2 ±6.7	4,865.30 ±181.2	4,861.4 ±160.2	3.78 ±0.01	183.5 ±5.7	4,697.8 ±148.8
	C ± to 1/8 RWH blooded		-24.9	-657.5*	+0.04	-22.3	-584.4	-721.9**	+0.04	-24.7*	-720.1**

Note *P>0.95, **P>0.99

Table 4 - Reproductivity of the purebred and holsteinized (1/2 RWH blooded) Simmenthal cows

Calving	Group of animals	n	Service period days	Interlactation period, days	Duration of pregnancy, days	Calving interval days	Live weight of animal yield, kg	Conception rate	Breeding efficiency of 1 conception, %	Number of calves, animal units	
										Live	Dead-born
1	C	25	103.2±14.0	-	277.9±0.6	-	32.5±0.5	1.6±0.1	52.0	19	6
	1/2 RWH blooded	25	87.9±9.9	-	281.9±1.3	-	32.5±0.5	1.5±0.1	48.0	20	5
	C ± to 1/2RWH blooded		+15.3	-	-4.0**	-	0	+0.1	+4.0	-1	+1
2	C	25	97.9±15.4	83.7±4.9	278.9±1.0	376.8±15.1	33.3±0.5	1.5±0.1	64.0	25	0
	1/2RWH blooded	25	104.7±13.5	78.6±9.2	281.8±1.2	386.5±11.1	32.5±0.5	1.7±0.1	40.0	24	1
	C ± to 1/2 RWH blooded		-6.8	+5.1	-2.9	-9.7	+0.8	-0.2	+24.0	+1	-1
3	C	25	84.1±8.9	63.9±6.7	279.5±1.2	363.6±16.6	33.2±0.5	1.3±0.1	72.0	25	2
	1/2 RWH blooded	25	90.9±13.7	66.3±8.9	280.6±1.2	371.5±14.7	32.8±0.5	1.4±0.1	60.0	24	1
	C ± to 1/2 RWH blooded		-6.8	-2.4	-1.1	-7.9	+0.4	-0.1	+12.0	+1	+1

Note: ** P> 0.99

The fat content in milk was higher in purebred heifers compared to holsteinized ones by 0.05% (P>0.95).

In the second lactation, the tendency to dominance in fat content in milk continued in purebred herdmates by 0.01%. In the third lactation, the difference was in favor of crossbred analogues - 0.05%, but the difference statistics was unreliable.

By the amount of 4% fat milk, the purebred heifers surpassed the crossbred ones by 183.1 kg, and in the subsequent two lactations, they were inferior - by 276.6 kg and 366.4 kg, respectively. By comparing the milk yield of full-grown cows and heifers, the best indicator was 80.4% in purebred Simmenthals, and 74.9% in the crossbred ones.

Therefore, in this case, the purebred Simmenthal cows, having smaller difference between the yield of young and adult cows, were able to yield more milk up to high productivity than their crossbred herdmates (1/4RWH blooded).

Table 3 provides data on milk productivity of the purebred and holsteinized (1/8RWH blooded) and Simmenthal cows by the first three lactations. The analysis of the obtained data has established that the holsteinized Simmenthals had an advantage over the purebred ones on the first lactation by 24.4 days, on the second lactation – by 7.8 days, and on the third lactation - by 24.9 days. By the amount of milk per lactation, the holsteinized (1/8RWH blooded) Simmenthals surpassed the purebred ones: for the first lactation - by 570.6 kg, for the second - by 719.9 kg (P>0.99), and for the third - by 657.5 kg (P>0.95), and on the yield of milk fat per lactation by 20.3 kg, 25.6 kg (P>0.99), and 22.3 kg, respectively. By the fat content in milk, the crossbred animals had indicators slightly below those of the purebred herdmates by 0.04-0.05%. At the same time, the intergroup differences by this parameter in the second lactation have proved to be statistically significant (P>0.95).

It should be noted that with advancing age, the fat content in milk of the cows of both groups increased insignificantly. The comparison of milk yields of full-grown cows and heifers in the compared groups turned out to be quite high: in purebreds - 82.7%, and in crossbreeds (1/8RWH blooded) - 82.15%. Therefore, the animals of both groups, in this case, turned out to be quickly-growing and capable of more intensively distributing themselves to high productivity.

By the amount of 4% fat content milk, the holsteinized (1/8RWH blooded) cows surpassed their purebred analogues by the first three lactations by 570.6 kg, 671.4 kg (P>0.99), and 584.4 kg, respectively.

It can be concluded from the studies that the holsteinized Simmenthal cows of all the genotypes obtained by improving the red-and-white Holstein breed had the superiority in milk yield and milk fat yield over pure-bred Simmenthal herdmates.

At the same time, the best results were observed in 1/8 blooded animals on improving red-and-white Holstein breed.

The comparative evaluation of the reproductivity of the purebred and holsteinized (different proportions of blood by the RWH) Simmenthal dams is of great practical and theoretical importance for identifying the most optimal genotype, successfully combining high milk productivity with good reproductive qualities in the prevailing economic conditions of feeding, keeping and servicing. The reproductivity indicators of animals were studied in the purebred and holsteinized Simmenthal cows. The data are presented in Tables 4-6.

When comparing the purebred cows and 1/2RWH blooded, an unreliable difference in the service period duration between the purebreds and holsteinized (1/2RWH blooded) Simmenthal heifers was found - 15.3 days in favor of the latter. After the second and third calving, the difference between the groups was insignificant - (6.8 days) - and unreliable, but in favor of the half-blooded cows. There was not revealed any significant differences between the purebred and holsteinized Simmenthals in terms of the calving interval duration between the first and second calving. The obtained data show that the calving interval in the animals of the compared groups was within 12-13 months, which complied with the requirements of this indicator for animals of dairy and mixed breeds.

The pregnancy duration in animals was within the normal limits, but in purebred Simmenthals it was shorter by 1.1-4.0 days. There was no significant difference between the groups in the live weight of new-born calves. It should be noted that in half-blooded animals calves were born heavier by 0.4-0.8 kg.

By the conception rate, the intergroup differences were insignificant, and by the relevant indicators, the compared animals were within the normal range of 1.3-1.7. By the breeding efficiency after the first conception, the purebred Simmenthals were the best ones with 52-72%, and in half-breeds, this figure averaged 40-60%. The reduced breeding efficiency in the holsteinized Simmenthals is possibly due to the increased production with prolactin pituitary, stimulating the secretion of milk. It should be noted that with advancing age, the breeding efficiency of the holsteinized Simmenthals returned to normal (60%).

The comparison of the purebreds and 1/4 blooded animals by RWH (Table 5) showed small intergroup differences in the duration of the service period (0.4-1.7 days), which smoothed after the first and second calving. After the third calving, the maximum duration of the service period was observed in the holsteinized (1/4 RWH blooded) Simmenthals – by 30.5 days longer than in purebreds (the difference was statistically unreliable). The calving interval in the comparative groups was also within the normal range of 367.9-382.2 days, with the exception of the holsteinized Simmenthal cows of the third calving, for which the average calving interval was 413 days due to a longer service period (by 30.5 days longer than in purebred Simmenthal cows). There was no statistically significant difference between the groups for the duration of pregnancy, and in animals, it was within the normal range. Heavier calves were born in crossbred animals, but the difference between groups on this basis was statistically unreliable. As in the first case, the compared groups after the first calving had high dead birth frequency: 24% - in the purebreds, and 20% - in the holsteinized. The obtained data also testify to the insufficient preparedness of the heifers for calving due to gastrointestinal diseases in the milking period. With age, the dead-birth rate has declined sharply (to 4%). The breeding efficiency in young animals in both groups was good - 64-68%, and with age, this indicator slightly decreased to 50-54.5%. Greater breeding efficiency was observed in the holsteinized Simmenthal cows - by 2.0-4.5%.

Table 5 - Reproductive properties of the purebred and holsteinized (1/4RWH blooded) Simmenthal cows

Calving	Group of animals	n	Service period days	Interlactation period, days	Duration of pregnancy, days	Calving interval days	Live weight of animal yield, kg	Rate of conception,	Breeding efficiency of 1 conception, %	Number of calves, animal units	
										Live	Dead-born
1	C	25	81.9±13.1	-	277.4±0.9	-	31.3±0.7	1.4±0.1	68.0	19	6
	1/4 RWH blooded	25	83.6±13.5	-	277.6±0.7	-	33.4±0.3	1.4±0.1	64.0	20	5
	C ± to 1/4 RWH blooded		-1.7	-	-0.2	-	-2.1	0	+4.0	-1	+1
2	C	25	88.7±15.2	67.3±8.7	279.2±0.6	367.9±13.7	32.1±0.7	1.5±0.1	52.0	25	0
	1/4RWH blooded	25	89.1±13.1	57.1±4.65	279.8±0.8	368.9±14.2	32.7±0.4	1.5±0.1	54.0	25	0
	C ± to 1/4 RWH blooded		-0.4	+10.2	-0.6	-1.0	-0.6	0	-2	0	0
3	C	20	100.2±21.8	74.2±6.6	282.3±1.3	382.5±16.6	31.5±0.8	1.4±0.1	50.0	20	0
	1/4 RWH blooded	22	130.7±22.0	84.8±6.0	282.3±1.1	413.0±14.2	31.9±0.5	1.7±0.2	54.5	21	1
	C ± to 1/4 RWH blooded		-30.5	-10.6	0	-30.5	-0.4	-0.3	-4.5	-1	-1

Table 6 - Reproductivity of the purebred and holsteinized (1/8RWH blooded) Simmenthal cows

Calving	Group of animals	n	Service period days	Interlactation period, days	Duration of pregnancy, days	Calving interval days	Live weight of animal yield, kg	Rate of conception,	Breeding efficiency of 1 conception %	Number of calves, animal units	
										Live	Dead-born
1	C	27	123.9±18.2	-	278.2±0.9	-	32.4±0.6	1.7±0.2	53.8	22	5
	1/8RWH blooded	27	128.1±16.1	-	277.0±0.6	-	31.9±0.1	1.8±0.1	37.0	21	6
	C ± to 1/8 RWH blooded		-4.2	-	- +1.2.	-	+0.5	-0.1	+16.8	+1	-1
2	C	25	95.8±10.8	91.4±6.4	281.7±0.9	405.5±19.2	32.1±0.6	1.5±0.1	56.0	24	1
	1/8 RWH blooded	27	106.4±10.2	86.4±6.9	280.2±0.9	408.3±17.0	32.6±0.5	1.6±0.1	42.3	25	3
	C ± to 1/8 RWH blooded		-10.6	+5.0	+1.5	-2.8	-0.53	-0.1	+13.7	-1	-2
3	C	25	121.6±18.4	89.3±4.2	280.9±1.1	376.8±13.6	32.7±0.0.5	1.8±0.2	43.8	26	0
	1/8 RWH blooded	26	85.8±11.3	75.3±4.7	281.4±0.9	387.8±10.1	32.3±0.6	1.4±0.1	62.5	25	1
	C ± to 1/8 RWH blooded		+35.8	+14.0	-0.5	-11.0	+0.4	+0.4	-18.7	+1	-1

The comparison of the purebreds and 1/8 RWH blooded (Table 6) has shown that the duration of the service period after the first and second calving was slightly higher in the holsteinized (1/8 RWH blooded) Simmenthals - by 4.2-10.6 days, but the difference was statistically unreliable. After the third calving, the service period duration in the crossbred cows was less than in the purebred cows - by 35.8 days, but this difference was statistically unreliable.

The duration of pregnancy in the animals of the compared groups was within the normal range (277-281.7 days). The conception rate in animals of both groups was in the range of 1.4-1.8, which corresponded to the norm. The breeding efficiency of the young purebred Simmenthals was higher by 16.8% than that in the crossbreeds. With advancing age, the breeding efficiency of animals of the compared groups fluctuated in favor of the purebreds (second calving), and then in favor of the holsteinized Simmenthals (third calving).

One of the important reserves for increasing milk productivity of the herd is to increase the duration of economic use of cows. Many researchers believe that the main factors influencing the duration of economic use of cows are the level of natural resistance of the animal organism and the feeding level during growing and operation in the milk production [2, 4, 5]. In most cases, the increase in milk productivity of cows has been accompanied by a decline in the average age of the animals in the herd due to the premature withdrawal of most cows. This usually occurs due to metabolism disorders, decrease in reproductivity, unsuitability to machine milking, and a number of specific animal diseases associated with the inability to adapt to operating conditions in the milk production (e.g., limb disease).

The greatest duration of economic use was observed for the holsteinized Simmenthal cows (by 0.26-0.64 lactations), but the difference was statistically unreliable. By the life milk yield, on average for one unit of livestock, the holsteinized Simmenthal cows also had the advantage by the first experiment - 7,696.68 kg (P>0.99), by the second - 3,087.08 kg, and by the third - 3,693.29 kg (P>0.95), respectively.

In addition, it should be noted that the holsteinized Simmenthal cows were also the best in terms of productivity for one year of use: on average, 4% fat per 590.6-642.8 kg of milk (P>0.99). Thus, under identical operating conditions, the holsteinized Simmenthal cows had the superiority by the lifelong dairy productivity over their purebred Simmenthal analogues.

Analysis of the data related to lifelong reproductivity has shown that the holsteinized crossbreds as compared to the purebred Simmenthals differed in the better maturing rate. Thus, the age of the first calving in half-blooded animals was less by 2.32 months (P>0.99), in 1/4 blooded (by Holstein breed) Simmenthals - by 2.38 months (P>0.95), and 1/8 blooded - by 1.31 months than in purebred Simmenthals. The average duration of the service period in animals of the compared groups was higher than normal. In the first two cases, longer service period was noted in crossbred animals (3.86-5.88 days), and in the third, vice versa, in purebred Simmenthals - by 7.03 days, but the difference in all cases was statistically unreliable.

The average interlactation period was slightly higher in the half-blood cows - by 2.59 days, and in the second and third cases, vice versa, in the purebred - by 11.21 days and 0.52 days, respectively (the intergroup difference obtained was statistically unreliable). On average, per one holsteinized Simmenthal cow more live calves had been obtained than from the purebred animals. The average number of dead births in the compared groups was low, and the difference was statistically unreliable.

In our studies, there have been no significant differences between the purebred and holsteinized Simmenthals in the calving interval. The obtained data show that the calving interval in the crossbred and purebred animals was within 12-13 months, which corresponded to the requirements for this indicator for dairy and mixed breeds of livestock.

The reproductivity ratio in animals of the compared groups had an average value with variations of 0.92-0.97. The Doha reproductivity index is one of the methods for assessing the reproductivity of cows, which combines the age of the first calving of an animal with a calving interval. This method allows to clearly distribute groups of animals in terms of their reproductivity. By the Doha reproductivity index, no reliable intergroup differences between the purebred and holsteinized Simmenthals were found. On the average value of the Doha index, all the compared groups of cows could be designated as those with average reproductivity, but in the purebred animals, this indicator was slightly lower than for the holsteinized animals - by 1.77-2.50. The results showed that the crossbreds had better fertility compared to the purebred analogues.

CONCLUSION

Economically, for milk manufacturers, the volume of additional products obtained as a result of new zootechnical activities is the most important factor. Due to this, the use of the holsteinized (1/8RWH blooded) Simmenthal cows for milk production is justified from the zootechnical and economic points of view.

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