MILK PRODUCTIVITY OF SIMMENTAL COWS AUSTRIAN SELECTION

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Abstract. The article presents data characterizing milk production and milk quality indicators of Simmental cows' Austrian selection of different productive types in the process of adaptation for the conditions of foothills of the North Caucasus, the Russian Federation. Simmental cows' milk type by the amount of milk produced is surpassing the cows (meat-dairy and dairy-meat) at the first lactation on 815 and 1934 kg at the second lactation – 904 and 2114 kg and at the third – 834 and 2030 kg. Analysis of the data revealed relatively high and stable lactation throughout the control period of the cows of all productive types. The content of dry matter, fat and protein in milk was more from the cows of meat-dairy type productivity. The content of nonessential amino acids in milk from the cows of meat-dairy type was more than from dairy cows by 14.5 %, dairy-meat by 9.6 %; the sum of essential amino acids – 11.6 and 7.2 %. During lactation, the number of essential amino acids and the total amino acid content decreased in milk from cows all of productive types. The Austrian Simmental cattle breeding different production types characterized as adaptable to the conditions of the North Caucasus foothills.

Keywords: Simmental cows' Austrian selection, dairy cattle, milk production.

Introduction

The Simmental is among the oldest and most widely distributed of all breeds of cattle in the world. Early records indicate that Simmental cattle were the result of a cross between large German cattle and a smaller breed indigenous to Switzerland. Although the first official herdbook was established in the Swiss Canton of Berne in 1806, there is evidence of large, productive "red and white" cattle being found much earlier in ecclesiastical and secular property records of Western Switzerland [1]. Those red and white animals were highly sought because of their "rapid growth development; outstanding production of milk, butter and cheese; and for their use as draught (draft) animals." They were known for their gentle nature, impressive stature and excellent dairy qualities [2].

Since its origin in Switzerland, the breed has spread to all six continents. Total numbers are estimated between 40 and 60 million Simmental cattle worldwide, with more than half in Europe. The worldwide spread was gradual until the late 1960's. Records show that a few animals were exported to Italy as early as the 1400's. During the 19th century, Simmentals were distributed through most of Eastern Europe, the Balkans and Russia [3-5].

Simmental breed heifers and semeen re-started to be imported after the year 2000, mainly from Austria and Germany. One of the reasons of the Simmental importations is that small and medium scale farm owners of costal and hilly areas are satisfied with milk & meat production of this breed (dualpurpose cattle) [6].

The cows of the Simmental breed are able to well adapt into foothill conditions and combine high genetic potential of milk and meat productivity [7]. However, between these productive characteristics different physiological nature exists, and by the breeding process there is a tendency to deviation of animal productivity into greater milk yield or meat productivity. Forming different productive types it is important to understand how the adaptation process will interact with the new climatic and economic conditions of the region [8]. The aim of the research is to study milk production and milk quality indicators of Simmental cows' Austrian selection of different productive types in the process of adaptation to the conditions of foothills of the North Caucasus, the Russian Federation.

Materials and methods

For the experiment 149 cows were selected, their milk productivity and qualitative indicators of milk were studied. The studied population was contained in one place and serviced by the same operators during three lactations. The productivity by the first lactation was assessed of 149 cows, by the second lactation – 132 cows, and the third by 112 cows (Table. 1).

After the first calving from productive use 11.5 % of cows were eliminated, after the second another 15.2 %, and to the third calving there were only 75.1 % of the cows left from the original herd [9].

Table 1

Results of milk productivity of cows of different productive types

Type of cows	*n*	Milk yield per lactation, kg	Content in milk, %		Content in milk, kg	
			fat	protein	fat	protein
1 lactation						
Dairy cattle	51	5766±154.2	4.09±0.03	3.26±0.01	235.9±3.0	188.1±2.2
Dairy-meat cattle	73	4951±106.2	4.11±0.02	3.29±0.01	203.5±2.3	162.9±1.6
Meat-dairy cattle	25	3832±125.8	4.16±0.04	3.34±0.02	159.3±2.4	128.0±1.7
Average by herd		5040.1	4.11	3.29	207.1	165.7
2 lactation						
Dairy cattle	49	6092±153.2	4.04±0.04	3.24±0.01	246.1±3.9	197.3±2.9
Dairy-meat cattle	61	5188±114.4	4.10±0.03	3.27±0.01	212.7±2.9	172.2±2.4
Meat-dairy cattle	21	3978±125.2	4.14±0.04	3.32±0.02	164.7±2.5	132.1±2.5
Average by herd		5106.0	4.08	3.26	207.5	165.8
3 lactation						
Dairy cattle	46	6087±152.2	4.03±0.05	3.21±0.01	245.3±4.4	195.4±3.2
Dairy-meat cattle	49	5253±113.9	4.08±0.03	3.26±0.01	218.7±3.0	174.7±2.6
Meat-dairy cattle	17	4057±134.5	4.11±0.05	3.30±0.03	166.7±2.2	133.9±2.7
Average by herd	-	5168.6	4.06	3.24	210.5	176.4

Mostly animals of meat-dairy type were eliminated: 16.0 % after the first calving and 32.0 % of the initial amount to the third calving. Almost similarly were the cows of dairy-meat type eliminated: 16.5 % after the first calving and 32.9 % after the second calving. Among dairy cows after the first calving 4.0 % of animals were eliminated, after the second calving 9.9 percent from the initial amount. It shows that dairy cows are characterized by longer production that is highly important for assessing the reproductive ability of the breed or type and the ability to adapt to new conditions.

The data were analyzed using PROC MIXED (SAS Version 9.2, Cary, NC, USA) as a split plot with the main unit in a completely randomized design with a 3×2×2 factorial arrangement of treatments [10]. The experiment unit was the cow. The initial linear models included the effects of the particle size (fixed), the method of evaluation (fixed), particle size×method interaction (fixed), cow nested in the particle size and the method of evaluation (random, main unit error), time of adaptation (fixed), time×particle size (fixed), time×method (fixed), time×particle size×method (fixed) and a random residual error. Linear models were reduced according to standard model reduction conventions. Generally, the time of adaptation effects and associated interactions were not important and were removed from the final models. Digestibility estimates were regressed on the particle size using initial linear models including both linear and quadratic components. Heterogeneity of regression was tested where interactions of the particle size and the method of evaluation occurred in the analyses fitting the particle size as a classification variable. The level of significance adopted was $p < 0.05$, while $0.05 \leq p < 0.10$ was considered as indicative of a trend.

Results and discussion

Studying milk production, the cows of the Simmental breed revealed significant differences between productive inbreeding types by received from them milk, milk fat, and protein.

From Simmental cows of the dairy type, the milk yield was greater than dairy-meat and meat-dairy cows by the first lactation on 815 and 1934 kg (16.5 and 50.4 %), by the second lactation – 904 and 2114 kg (17.4 and 53.1 %) and the third – 834 and 2030 kg (15.8 and 50.1 %). The highest content of fat and protein were in milk from the meat-dairy type of cows - 4.16 and 3.34 percent, the lowest into milk from the dairy type of cows 4.09 and 3.26 % and the dairy-meat type of cows – 4.11 and 3.29 %.

By the first lactation from dairy cows 235.9 kg of milk fat were received, that is by 32.4 and 76.6 kg more than from dairy-meat and meat-dairy type of cows; by the second lactation – 32.4 and 44.2 kg, by the third – 33.4 and 81.4 kg. For three lactations milk protein from animals of the dairy type was obtained by 186.8 kg more than of the meat-dairy type of cows and more by 71.0 per kg than the dairy-meat type of cows; milk fat by 236.6 and 92.4 kg.

By live weight throughout the research the advantage was on the side of the animals of the meat-dairy type. They surpassed the cows of the milk type at the first lactation by 43 kg, by the third – 60 kg. The advantages of the cows of the meat-dairy type over the dairy-meat type by live weight were 15 kg and 20 kg. With increasing significantly the age, the differences by live weight between cows of productive types increase in favor of the meat-dairy type.

Cows of different types distinguished high stability coefficient of milk production. By the first three lactations it changed from dairy cows from 9.56 to 9.65; dairy-meat from 7.79 to 8.04 and meat-dairy from 5.89 to 6.01.

The lactation curve (Fig. 1) characterizing dynamics of the milk yield of cows during lactation shows that in cows of different type higher milk yield is observed at the third month of lactation, with a gradual decline in subsequent months of lactation.

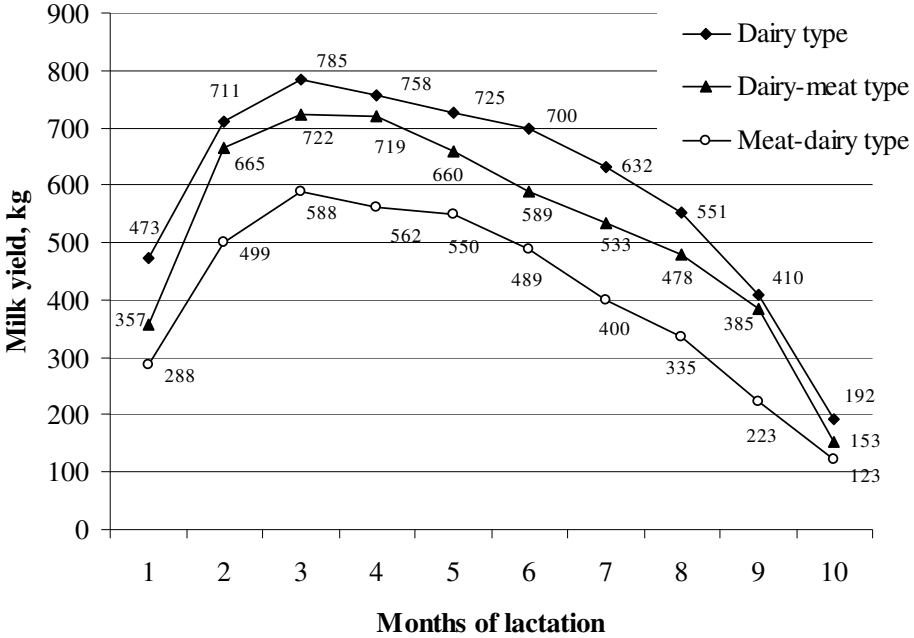

Fig. 1. **Lactation curves of cows**

Analysis of the lactation curves also shows a relatively high and stable lactation throughout the control period, what is confirmed by the coefficient of stability of lactation (CSL). In dairy cows, dairy-meat and meat-dairy types it is 90.2; 88.6; 85.9 %.

The qualitative composition of milk from cows of different types shown in Table 2, the data show, that more dry matter, fat and protein is found in milk from the cows of the meat-dairy type, less in milk from the cows of the dairy type.

Animals of dairy-meat type are between dairy and meat-dairy types. And this ranking distribution by the qualitative composition of milk is observed for all of the three lactations. Milk from animals of different productivity types is characterized by a pretty high content fat and protein that determine the calorie content of the product and the highest content of casein in milk was from the cows of the meat-dairy type, the lowest in milk from dairy cattle. The lowest concentration of lactose in milk was from dairy cattle – 4.49-4.45 %, from meat-dairy cows there was the highest content of this component 4.52 to 4.54 %. Cow's milk from all of the types has high energy value, and the difference between the groups was insignificant. It should be noted that by comparison with the first-month lactation to the fifth the content of protein in milk from dairy cows decreased from 33.1 $g \cdot kg^{-1}$ to 28.7 $g \cdot kg^{-1}$ (15.3 %), from the dairy-meat and meat-dairy cows by 13.5 and 11.3 %.

Table 2

Chemical composition the milk of Simmental cows

Type of cows	Dry matter, %	Content in milk, %							Energy value 1 kg milk, MJ
		fat	protein	casein	whey proteins	lactose	ash	nonfat milk solids	
1 lactation									
Dairy	12.53	4.09	3.26	2.85	0.41	4.49	0.69	8.63	2.92
Dairy-meat	12.59	4.11	3.29	2.86	0.43	4.50	0.69	8.66	3.0
Meat-dairy	12.72	4.16	3.34	2.88	0.46	4.53	0.69	8.72	3.07
2 lactation									
Dairy	12.43	4.04	3.24	2.83	0.41	4.47	0.68	8.59	2.93
Dairy-meat	12.56	4.10	3.27	2.86	0.41	4.50	0.69	8.66	3.00
Meat-dairy	12.67	4.14	3.32	2.87	0.45	4.52	0.69	8.69	3.09
3 lactation									
Dairy	12.37	4.03	3.21	2.82	0.39	4.45	0.68	8.57	2.91
Dairy-meat	12.52	4.08	3.26	2.85	0.41	4.49	0.69	8.63	2.92
Meat-dairy	12.64	4.11	3.30	2.88	0.42	4.54	0.69	8.73	3.08

Conclusions

1. By milk production for three lactations, the Simmental cow's Austrian selection of the dairy type has the best result. From the cows of the milk type the highest yield of milk, milk fat and protein was obtained. In average for three lactations, milk yield per cow of this type was superior to the other by 851 and 2028 kg. But the specific content of dry matter, fat, and protein in milk was more from the cows of the meat-dairy type.
2. The results identify the herd as productive with steady lactation curves. In the cows of the dairy type the coefficients of usefulness lactation (74.4 %) were the greatest, for the cows of the other types they were 71.7 and 68.0 %, which is typical for cows with aligned lactation. These cows were used longer in the herd and they often recorded the highest lifetime milk yield.
3. The obtained results characterize the Simmental cattle of different productive types as adaptable to foothill conditions.

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