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Exterior Features And Milk Productivity Of Simmental Cows Of Different Production Types

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Annotation. *The article presents data on the study of exterior characteristics and milk productivity indicators of Simmental cows of different production types, imported to the Republic of Uzbekistan from European countries. The data obtained on the milk productivity of experimental Simmental cows shows that this imported cattle is well adapted to hot climate conditions. Dairy type cows are distinguished by their tall stature with an elongated body, deep chest, strong constitution, desirable shape and optimal udder measurements, which determined high milk productivity and better suitability for machine milking compared to dairy-meat and meat-dairy types. The average daily milk yield of full-aged Simmental cows of the dairy type for the first 100 days of lactation was 16.83 kg with a milk fat content of 3.82%, which is 8.6 and 15.6% more than cows of the dairy-meat and meat-dairy types. Dairy cows also used fewer energy feed units per unit of production compared to other types. To form dairy herds of Simmental cattle, it is recommended to select according to the physique, shape and measurements of the udder and milk productivity of first-calf heifers.*

Key words: *Simmental breed, production types, exterior, body type, udder shape, milk yield rate, udder index, measurements, milk yield, milk fat content, milk protein content, milk fat yield, conversion, feed payment in milk.*

INTRODUCTION. The Simmental breed of cattle, due to its best economically useful characteristics, combining optimal milk and meat qualities and good adaptation to various climatic conditions, has become widespread in all countries of the globe and amounts to about 40 million heads. In the Simmental breed, animals of the dairy, dairy and meat and dairy types are distinguished, which differ from each other in the level of milk productivity, live weight, body size and constitution. The division of animals into production types makes it possible to focus selection and breeding work with the breed in order to create cows of the most suitable type of the applied technology. In the conditions of industrial milk production technology with group keeping of Simmental cows in sections, milking them on high-performance milking units, dairy cows are most suitable [3,4]. The highest milk productivity, the highest profitability of milk production and the best indicators of morphofunctional properties of the udder are found in dairy cows, and the best indicators of reproductive capacity are characterized by beef and dairy cows [5].

The study of hematological parameters of the blood of cows of different production types shows the presence of significant differences between them, which determines the level of metabolic processes in the animal's body. It was established that in dairy cows of the Simmental breed, the number of erythrocytes was greater than the same indicator in animals of the beef and dairy and beef and dairy types by 12.7 and 22.8%, respectively, and in terms of the number of leukocytes, they have an advantage over beef and dairy cows by 15.7%, numerically not differing from their dairy and beef analogues [6].

The data obtained in the course of research by a number of authors confirm the dependence of the heritability of milk yield in cows on the expression of their constitutional-productive type. Intra-breed types of Simmental cattle are largely determined by genetic factors and selection for this trait can be effective [7].

In recent years, a significant number of breeding cattle of various breeds has been imported to the Republic of Uzbekistan, among which Simmental is one of the leading ones. The breed is planned for breeding in the foothills of the republic. A number of domestic scientists in their studies have stated that the study of the productivity and adaptability of imported Simmental cattle and their offspring obtained in new climatic and technological conditions allows us to draw positive conclusions about the acclimatization of this cattle.

In Uzbekistan, Simmental cattle, mainly heifers, are imported from Hungary, Germany, Austria and other European countries. In the period 2020-2022, a total of 31,982 heads of Simmental cattle were imported to the republic and are successfully bred in all regions and in the Republic of Karakalpakstan. The main population of breeding cattle is located in the foothills of Kashkadarya (4841 heads), Fergana (3715 heads), Tashkent (3493 heads), Samarkand (2944 heads) and other regions of the republic [2]. In the natural and

climatic conditions of the foothills of Uzbekistan, imported Simmental cattle have demonstrated their economically useful properties as in their homeland. Keeping them in permanent buildings in boxes and walking areas with full feeding contributed to the manifestation of the genetic potential of productivity: milk yields of cows per lactation reached 4960-5055 kg with a milk fat content of 3.91-3.99% [1]. However, the productive and adaptive qualities of imported Simmental cattle to hot climate conditions have not been sufficiently studied and further research is required to fully realize the genetic potential of the breed. Today, it is very important to form breeding herds and selection groups based on improving the breeding and productive qualities of the Simmental breed in the conditions of the sharply continental climate of the republic.

RESEARCH AND METHODS. Research on some biological and economically useful traits of Simmental cattle of different production types was carried out on the cattle farm of the K-Eldor farm, located in the valley of the Zarafshan River in the Samarkand region in the period from November 2024 to January 2025.

Simmental cattle were brought to the farm in several batches from European countries, the last of which was brought in 2021 in the amount of 400 heads. To conduct scientific and economic experiments, 3 groups of cows of the third and older calvings were formed, 15 heads each. The first group included Simmental cows of the dairy type, the second - dairy and meat type, and the third - meat and dairy type.

Winter rations were composed taking into account the capabilities of the farm and balanced in energy, protein and mineral nutrition. Feed intake and consumption during the experiment were determined by recording the specified feeds and their remains every ten days.

The exterior and constitutional features of the cows were studied in the second month of lactation by visual assessment, taking body measurements and then calculating the constitution indices.

The morphofunctional indices of the cow udder were studied using the generally accepted methods in animal husbandry. Milk productivity was determined by test milkings every ten days, fat content was determined by the acid method according to Gerber, protein by the formol titration method, dry matter and other components of milk by the calculation method.

RESEARCH RESULTS. The feeding and housing conditions of all experimental groups of cows were the same. The cow rations were composed taking into account live weight and milk productivity based on the capabilities of the farm and balanced in energy and mineral nutrition, as well as in carotene. Feed consumption by animals of the experimental groups differed slightly between the groups due to the actual feed intake (Table 1). During the experimental period (the first 100 days of lactation), dairy cows consumed 23.6 (1.41%) and 36.7 (2.2%) more energy feed units with feed compared to the II and III experimental groups, respectively.

Table 1. The amount of feed eaten by experimental cows and its nutritional value, kg (on average per head).

Indicators	Groups		
	I	II	III
Alfalfa hay	490	485	480
Wheat straw	280	270	260
Corn silage	2200	2150	2120
Haylage	550	540	545
Semi-sugar beetroot	600	600	600
Wheat flour	100	100	100
Barley husk	80	80	80
Corn shit	90	90	90
Wheat bran	70	70	70
Table salt	9,0	9,0	9,0
Disodium phosphate	10	10	10
Contained in feed:			
Energy feed units	1695,1	1671,5	1658,4

Dry matter	1835,3	1809,7	1795,6
Digestible protein	140,13	138,18	137,09
Crude fiber	481,4	474,7	471,0
Sugar	99,27	98,51	98,18
Raw fat	58,33	57,39	56,95
Table salt	9,0	9,0	9,0
Calcium	15,05	14,84	14,71
Phosphorus	6,82	6,78	6,75
Carotene	0,1	0,1	0,1

Numerous studies have established that the body measurements and body structure of animals are closely related to their economically useful traits.

The best productive qualities were found in cows that are tall, have a deep chest and body, large chest girth, large width at the hips and oblique body length, and also have a long, wide and deep udder. A study of the relationship between milk productivity and body types shows that the highest milk productivity is possessed by cows whose type combines a wide body, density and tenderness, and the lowest milk yields were found in cows combining a wide or narrow body with looseness and coarseness [3].

The measurements of experimental animals show (Table 2) that Simmental cows of the dairy type differ from other production types of cows in their tallness, long body with a deep chest and relatively tender bones. Thus, their height at the withers is greater than that of the dairy-meat and meat-dairy types by 2.6 (1.9%) and 3.5 (2.6) sm, the oblique length of the body is 1.4 (0.8%) and 1.2 (0.7%) sm, the depth of the chest is 1.2 (1.6%) and 0.7 (0.9%) sm, respectively.

Table 2.Body measurements of experimental cows, sm, ($\bar{x} \pm S\bar{x}$)

Body measurements	Groups		
	I	II	III
Height at withers	140,7±1,54	138,1±1,52	137,2±1,49
Height at the sacrum	145,2±1,76	143,4±1,71	142,8±1,68
Oblique body length	169,0±1,89	167,6±1,74	167,8±1,73
Chest depth	74,9±0,72	73,7±0,70	74,2±0,67
Chest width	47,0±0,32	47,9±0,34	49,2±0,38
Width in maclocs	56,9±0,40	57,4±0,38	58,5±0,36
Width at ischial tuberosities	29,5±0,19	30,3±0,21	31,1±0,23
Chest circumference	191,8±1,96	193,6±1,98	196,3±2,01
Metacarpus girth	20,1±0,20	20,4±0,21	20,7±0,22

In cows of the dairy-meat and meat-dairy types, the following measurements prevailed in comparison with the dairy type: chest width by 0.9 (1.9%) and 2.2 (4.7%), hip width by 0.5 (0.9%) and 1.6 (2.8%), and metacarpal girth by 0.3 (1.5%) and 0.6 (3.0%) sm, respectively.

Table 3. Body condition indices of experimental cows, % ($\bar{x} \pm S\bar{x}$)

Indexes	Groups		
	I	II	III
High-legged	46,8±0,26	46,6±0,24	45,9±0,23
Stretching	120,1±0,68	121,4±0,71	122,3±0,72
Pelvic-thoracic	82,6±0,41	83,4±0,43	84,1±0,45
Chest	62,7±0,32	65,0±0,34	66,3±0,37
Knockdowns	113,5±0,48	115,5±0,52	117,0±0,53
Overgrowth	103,2±0,39	103,8±0,42	104,1±0,44
Stubby-buttocks	192,9±1,24	189,4±1,18	188,1±1,16
Boniness	14,3±0,04	14,8±0,05	15,1±0,05

Although animal body measurements are an objective method for assessing the exterior, they cannot give a complete picture of the animal's constitution. Taking this into account, the constitution indices of the experimental cows were calculated (Table 3). The data in the table show that the cows of the meat-and-dairy and dairy-and-meat constitution types were more elongated and less high-legged, had higher indices of the pelvis-chest, chest, compactness, overgrowth and boneiness compared to the cows of the dairy type, and the cows of the dairy type were taller and had higher legs. It should be noted that the difference in constitution indices between the groups is insignificant and the differences are statistically insignificant.

With intensive technology for industrial milk production, the suitability of cows for machine milking is of great importance, especially in herds of Simmental cattle, characterized by a low specific gravity of cows suitable for machine milking. The morphofunctional properties of the udder have intrabreed differences, which is associated with both individual characteristics and selection work carried out differently in different countries [4].

The relevance of cow selection based on morphofunctional features is due to the fact that milking machines have design limitations that do not take into account the individual features of the udder structure. Therefore, it is advisable to conduct selection work aimed at improving the morphofunctional indicators of the udder of cows, especially since these features are hereditary [3].

It is known that there is a certain relationship between the shape, size and milk productivity of cattle.

The udder structure of the cows in the experimental groups was cup-shaped and rounded. In Group I, the number of cows with a cup-shaped udder was 9 heads (60%) and rounded - 6 heads (40%); in Group II - 8 (53.3%) and 7 (46.7%) heads; in group III – 6 (40%) and 9 (60%) heads respectively.

Table 4. Udder measurements of Simmental cows of different production types, sm ($\bar{x} \pm S\bar{x}$)

Measurements	Groups		
	I	II	III
Udder girth	116,2±2,4*	112,7±2,2	108,6±2,1
Udder length	31,9±0,5*	30,6±0,4	28,9±0,3
Udder width	30,2±0,4**	28,2±0,3	26,7±0,3
Forequarter depth	24,1±0,3**	22,4±0,3	21,8±0,2
Depth of hind quarters	27,5±0,4**	26,7±0,4	25,1±0,3
Distance from the bottom of the udder to the floor	63,4±0,9*	61,3±0,8	59,2±0,8
Conventional udder volume	2997,9	2766,8	2546,7
Length of anterior nipples	6,5±0,09	6,4±0,08	6,3±0,08
Length of posterior nipples	6,0±0,08	5,9±0,07	5,8±0,07
Diameter of the anterior nipples	2,4±0,05	2,3±0,04	2,3±0,03
Rear nipple diameter	2,7±0,05	2,6±0,04	2,5±0,04
Front nipple girth	8,3±0,12	8,2±0,11	8,0±0,11
Girth of the posterior nipples	8,2±0,07	8,0±0,06	7,8±0,07
Distance between the front nipples	13,7±0,19	13,2±0,18	13,0±0,17
Distance between the rear nipples	9,6±0,09	9,4±0,08	9,0±0,08
Distance between lateral nipples	9,8±0,11	9,6±0,11	9,3±0,10

Note: *P> 0,95; **P> 0,99

The measurements of the cows' udders characterize not only the development of the mammary gland, but also its suitability for machine milking. The results of taking measurements show that the dairy cows surpassed their peers of other types in the main udder measurements (Table 4). The cows of this group have an udder girth that is 3.5 and 7.6 sm higher, an udder length that is 1.3 and 2.0 sm higher, a width that is 2.0 and 3.5 cm higher, and a distance from the bottom of the udder to the floor that is 2.1 and 4.2 sm higher compared to the cows of the dairy-meat and meat-dairy types, respectively.

It was also established that the dairy cows are superior to the dairy-meat and meat-dairy cows in the size and location of the teats, which makes them more suitable for machine milking.

Table 5. Functional properties of the udder of experimental cows ($\bar{x} \pm S\bar{x}$), n=15

Indicators	Groups		
	I	II	III
Average daily milk yield, kg	19,2±0,51**	17,4±0,46*	15,8±0,41
Milking duration, min.	10,9±0,12	10,6±0,11	10,3±0,09
Milk flow rate, kg/min	1,76±0,03**	1,64±0,02*	1,53±0,02
Udder index, %	43,2	42,9	41,4

Note: *P> 0,95; **P> 0,99

Along with the morphological features of the udder, the functional features of the cow's udder are also important, since these properties determine their adaptability to machine milking. The intensity of milk flow affects the complete milking, and the udder index characterizes the uniformity of the development of the front and back lobes of the udder.

The highest intensity of milk flow was noted in dairy cows (1.76 kg / min), which is 7.3 and 11.5% higher than the dairy-meat and meat-dairy types. They also have more uniformly developed front and back parts of the udder, which is evidenced by a relatively high udder index (Table 5).

The milk productivity of the experimental cows during the experiment was different in groups (Table 6). The highest milk yields were obtained from dairy cows (1683.4 kg), which is 133.8 kg (8.6%) and 227.2 kg (15.6%) more than dairy-meat and dairy-meat cows, respectively. There was an insignificant difference in the fat content in milk between the groups, with the milk fat content of group III cows being higher than that of groups I and II by 0.09 and 0.04%, respectively. A comparatively high milk protein content was also noted in dairy-meat cows compared to other groups. No significant differences were found in other milk components between the groups.

Due to high milk yields, the amount of milk fat during the experiment was higher in group I cows by 4.35 kg (7.2%) and 7.37 kg (12.9%) compared to groups I and II, respectively. The milk protein yield was also higher in dairy cows by 4.49 (8.9%) and 7.07 (14.9%) kg compared to dairy-meat and meat-milk cows, respectively.

Table 6. Milk productivity of experimental cows during the experimental period ($\bar{x} \pm S\bar{x}$), n=15

Indicators	Groups		
	I	II	III
Milk yield, kg	1683,4±26,65**	1549,6±26,00	1456,2±26,66
Milk fat content, %	3,82±0,057	3,87±0,061	3,91±0,064
Protein content in milk, %	3,24±0,026	3,23±0,029	3,26±0,031
Lactose, %	4,71±0,03	4,70±0,04	4,70±0,03
Mineral substances, %	0,75±0,01	0,76±0,01	0,76±0,03
Dry matter, %	12,52±0,05	12,56±0,06	12,63±0,06
Dry nonfat milk residue, %	8,70±0,04	8,69±0,04	8,72±0,05
Milk fat yield, kg	64,31**	59,96	56,94
Milk protein yield, kg	54,54**	50,05	47,47

Note: **P> 0,99

Table 7. Milk productivity of experimental cows depending on the shape of the udder ($\bar{x} \pm S\bar{x}$)

Udder shape	Number, goals	Groups		
		Milk yield per 100 days, kg	Average fat content of milk, %	Milk fat yield, kg
Milk type				
Cup-shaped	9	1826,4±34,62	3,81±0,059	69,58
Rounded	6	1468,9±28,36	3,84±0,056	56,40

Milk and meat type				
Cup-shaped	8	1704,8±32,76	3,86±0,057	65,80
Rounded	7	1372,2±27,61	3,88±0,061	53,24
Meat and dairy type				
Cup-shaped	6	1609,6±29,31	3,90±0,062	62,77
Rounded	9	1353,9±26,76	3,92±0,064	53,05

It is evident from the data in Table 7 that the milk yield of cows is closely related to the shape of the udder. The highest milk yields were in cows with a cup-shaped udder. In the first group of cows (dairy type), milk yields for the first 100 days of lactation from cows with a cup-shaped udder were 357.5 kg (24.3%) more milk compared to cows with a round udder. A similar picture was observed in other experimental groups. In terms of milk fat content, there were more significant differences in this feature in cows with a cup-shaped udder.

Table 8. Conversion of feed to milk in experimental cows depending on the production type

Indicators	Groups		
	I	II	III
Dry matter feed consumed, kg	1835,3	1809,7	1795,6
Total ECE consumption	1695,1	1671,5	1658,4
Milk yield, kg	1683,4	1549,6	1456,2
Conversion of dry matter of feed per 1 kg of milk	1,09	1,17	1,23
Milk obtained per 1 kg of dry matter of feed, kg	0,91	0,86	0,81
EKE consumption per 1 kg of milk	0,92	1,08	1,14

Feed payment by products in cattle breeding plays an important role in the economic efficiency of food production, since the share of feed costs in the cost structure is very high. From the data in Table 8 it is clear that cows of Group I spent 6.8 and 11.4% less dry matter of feed per 1 kg of milk compared to Groups II and III, respectively. Based on 1 kg of dry matter of feed, dairy cows produced 0.05 (5.8%) and 0.1 (12.3%) more kg of milk compared to dairy and meat and dairy types. The consumption of energy feed units for the production of 1 kg of milk was also less for cows of Group I compared to others.

CONCLUSION.

Simmental cattle are well adapted to the conditions of the sharply continental climate of Uzbekistan, which is expressed in good milk productivity of cows. Simmental dairy cows have a strong constitution, well-defined dairy forms, are distinguished by their tall stature, deep chest, elongated body, desirable shapes and optimal measurements of the udder and high milk productivity compared to the dairy-meat and meat-dairy types. Dairy cows have high milk productivity and better milk return on feed. To form and improve dairy herds of the Simmental breed, it is advisable to select for exterior, constitution, morphological features of the udder and milk productivity.

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