

EVALUATION OF THE EXTERIOR AND PRODUCTIVE QUALITIES OF FIRST-HEIFER COWS OF THE JERSEY

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Abstract

The article presents the results of the study of productive indicators and features of the exterior of the trunk and morphological properties of the udder of first- heifer cows of Jersey breed. The research was carried out in the herd of the breeding farm Society of limited liability "Topal-Bereket", town Comrat on first-heifer cows of Jersey breed. Analysis of milk productivity of the pedigrees of female ancestors of first-calf heifers showed that the highest milk yield and fat content were at the mothers of fathers - 8772 kg of milk and 6.02% of fat. On average, the milk yield of first-calf cows for 305 days of the first complete lactation was 4660 kg of milk with a fat content of 5.96%, the amount of milk fat - 276 kg. Exterior assessment showed that the height at the withers of the first Jersey heifers averaged 126.0 cm, and the height at the croup was 131.1 cm. The chest is deep and wide and averaged 63.7 cm and 40.5 cm, respectively. The bone is thin - the girth of the pastern is 16.6 cm. First heifers of the Jersey breed are characterized by a compact physique with an undercut index of 115.7%, which is characteristic to them during the studied period of development. The relationship between girth and width of the udder and milk yield per lactation of Jersey first-calf cows is weak and positive and amounts to 0.092 and 0.102, respectively. The correlation between the length, width and girth of the udder and the fat content in milk is weak and amounts to +0.123, +0.053 and +0.158, respectively.

Key words: correlation, exterior, first-heifer cow, Jersey breed, milk yield.

INTRODUCTION

Increasing the production of livestock products, including milk, is the primary task of workers in the agricultural sector of the Republic of Moldova. One of the ways to solve it is the use of highly productive animals.

At present, the most widespread in our republic are the Moldavian type of black-motley cattle, the Holstein breed, the delivery of Jersey heifers has begun. The Jersey cattle breed was bred on the island of Jersey, which is located off the coast of England. This area is characterized by a mild climate that allows animals to be kept in very good pastures for most of the year.

A small area of the island, on which the animals were kept, was isolated, which contributed to the consolidation of the breed characteristics, as a result of which the animals of this breed have a conservative heredity and pass such a quality as fatty milk well to descendants (Dankvert, 2004). In 1789, it was organized a special agricultural society, the purpose of which was to improve the Jersey cattle breed. The first Jersey cattle exhibition took place in 1834, and the first

volume of the herd book was published in 1872. The breeding of valuable families and lines was carried out by the scientists- cattle breeders Duncan and Daunan (Ruban, 1960). After the breeding of valuable lines of the Jersey cattle breed, its active spread to other countries of the world began, which continued to engage in the selection of this breed. The Jersey breed is predominantly bred in their homeland of Britain. Currently, the Jersey breed is being bred in Denmark, Hungary, France, Italy, and the USA. According to research conducted by the Ministry of Agriculture of the USA in 2006, Jersey is the main breed in 4% of American dairy farms (Drackley et al., 1996; Drackley, 2008). Due to strong demand for Jersey cattle in the United States, Jersey has become the fastest growing breed. More than 235,000 Jersey cows are enrolled on production testing programs in the United States. Actual yield per cow for 2012: 7,782 kg milk, fat - 371 kg, protein - 283 kg, Cheddar cheese yield - 979 kg. U.S. Jerseys produce, on average, more than 17 times their body weight in milk each lactation (www.usjersey.com/).

To important qualities of this breed refer high genetic potential, early maturity, the presence of a uniformly developed udder with a high milk flow rate, strong limbs and hooves. In 1992, the productivity of Jerseys (standardized milk) was 6779 kg, in 2010 it reached 8673 kg per livestock of 59 604 cows with a fat content of 4.7%, protein - 3.5% (Goncharenko & Vinnichuk, 2014). In terms of dry matter, Jersey milk is significantly superior to that of US Holsteins (Capper & Cady, 2012).

The delivery of Jersey cattle to Denmark began in 1896, then active work began to improve the milk yield and fat milk yield of the breed. Purebred and crossbred animals of this breed make up 18% of the total population. As a result of active breeding work in individual herds, were achieved the highest results in terms of milk yield for 305 days of lactation - 9175 kg of milk with a mass fraction of fat of 5.67% (Barendse et al., 2001, Agasiev, 2005). Jersey is the second-most-common dairy breed in Denmark, making up 13% of the dairy stock in Denmark, whereas Holstein-Friesian is the most dominant breed at 70% of all dairy stock (RYK, 2013; Kristensen et al., 2015). This could be part of the reason why Prendiville et al. (2009) found that Jerseys have higher gross energy efficiency (milk solids/DMI) than Holsteins, despite a lower milk-solid production. Milk yield across systems and breeds has been increasing, from 7,900 kg of ECM in 2004 (Kristensen & Kjærgaard (2004) to 9,500 kg in 2010 (RYK, 2013).

On the exterior, jersey belongs to the pronounced milky type. The constitution of animals of this breed is characterized by a light and thin bone (pastern girth 15-16.5 cm), flat and elongated body, dense and dry muscles, angular shape, small and light head with a shortened facial part, forehead with a narrow and concave profile. The height at the withers is 120-123 cm. The most valuable qualities of the Jersey breed are: uniformly developed udder, early maturity, strong limbs and hooves. The average live weight of full-aged animals varies in the range of 360-400 kg for cows, 650-700 kg for bulls; the birth weight of calves is 18–22 kg (Aleshkina, 2008; Dankvert, 2011; Ruban, 2011).

In countries with developed livestock breeding, animal conformation continues to be a priority in breeding programs, since there is its relation-

ship with productivity, in addition, harmoniously developed individuals are more adapted to progressive technologies for the production of livestock products (Foksha & Konstandoglo, 2012). The exterior is one of the main breeding characteristics of dairy cattle (Loboda, 2012; Stavetska et al., 2013; Khmelnichy, 2007). The entire history of the creation and improvement of cattle breeds in the twentieth century was based on the development of the idea of the desired exterior type of animals Khmelnichy, (2010). In recent years, Jersey heifers have been imported into the Republic of Moldova. The first batch of heifers of this breed was purchased from Denmark in 2019 by SLL "Topal-Bereket". The purpose of this work was to study the productive indicators and features of the exterior of the trunk and morphological properties of the udder of first-calf cows of Jersey breed.

MATERIALS AND METHODS

The material for the research was first-heifers Jersey cows (n = 45) on the breeding farm of SLL "Topal-Bereket" (Society of limited liability), Comrat, which were imported from Denmark. Evaluation and analysis of animals for milk productivity was carried out according to generally accepted methods, taking into account: milk yield for 305 days of lactation, fat content in milk (%), amount of milk fat (kg). The genetic productivity potential of first-heifers was determined on the basis of the parental index of cows (PIC) Beauty, (1999) according to the formula: $PIC = (2M + MM + MO) / 4$, where: M - mother's productivity; MO is the productivity of the father's mother; MM is the mother's productivity. The realization of the genetic potential (RGP) was determined by the formula: $RGP = \text{actual productivity} / \text{expected productivity according to PIC} \times 100\%$, of the parental index of cows (PIC).

Exterior and constitutional features of first-heifers cows were studied by taking measurements and calculating their constitution indices. The measurements of the animals were carried out 2-3 months after calving (Basovsky, 1983; Belozertsova, 2011). Physique indices were calculated according to the generally accepted method (Kostomakhin et al., 2007). The assessment of the morphological properties of the udder was carried out on 2-4 months of

lactation according to the method of Karelin & Starkov (1968). For the studied features were determined, the arithmetic mean (M), the error of the mean ($\pm m$), the coefficient of variation (Cv), the reliability of the difference according to the Student's criterion (P). Statistical data processing and correlation analysis were performed according to Merkurjeva & Shangin-Berezovsky (1983) using the Microsoft Excel 2010 software package.

RESULTS AND DISCUSSIONS

Analysis of the productivity of the pedigrees of female ancestors of first-heifers Jersey breed found that the highest milk yield and fat content were found in mothers of fathers, that, due to the fact that all first- heifers are the daughters of high-value breeding bulls of the Jersey breed, tested for the quality of offspring (Table 1).

Table 1. Productivity of female ancestors of the Jersey breeds population, SLL "Topal-Bereket" ($X \pm S_x$)

Productivity for the highest lactation	Indices					
	Milk, kg	Cv, %	Fat, %	Cv, %	Fat, kg	Cv, %
Mothers	7459 \pm 186.9	16.6	5.73 \pm 0.07	8.5	425 \pm 9.6	14.9
Father's mothers	8772 \pm 234	16.7	6.02 \pm 0.08	7.8	525 \pm 11.7	14.0
Mother's mothers	7835 \pm 250.5	21.2	5.81 \pm 0.08	9.4	449 \pm 10.5	15.5

The milk yield of the fathers' mothers in the highest lactation was 8772 kg of milk with a fat content of 6.02%, the amount of milk fat - 525 kg. The milk yield of the highest lactation of mothers averaged 7459 kg of milk, which is by 1313 kg less than that of the father's mothers, the difference is significant ($P < 0.001$).

The milk productivity of mother's mothers for the highest lactation averaged 7835 kg of milk with a fat content of 5.81%, the amount of milk fat - 449 kg. The smallest coefficient of variability for all analysed groups of animals was found for the amount of milk fat 14.0-15.5% (limit 18-32%). In terms of milk yield (16.6-21.2%) and milk fat content (7.8-9.4%), the

coefficient of variability was slightly higher than the literature data on average by 1.6-6.0% and 2.8-4.4% respectively.

This confirms the long-term intensive selection according to the analysed economically useful traits of the female ancestors of this population of Jersey breed.

It was carried out the final analysis of milk productivity of first-heifer cows for 305 days of first lactation (Table 2).

It should be noted that the average milk yield of first-heifer cows amounted to 4660 kg of milk with a fat content of 5.96%, the amount of milk fat - 276 kg. The coefficient of variability for all analysed characteristics was below the norm.

Table 2. Characteristics of first-heifer cows of Jersey breed in terms of milk production for 305 days of lactation

Indices	Milk, kg	Cv, %	Fat content, %	Cv, %	Fat amount, kg	Cv, %
M \pm m	4660 \pm 30.6	4.2	5.96 \pm 0.03	3.4	276 \pm 3.5	8.2

For a more complete assessment of the potential capabilities of first-heifer cows according to the analysed indicators of female ancestors, we calculated the parental index of cows (PIC), which shows the genetic capabilities of the animal and the degree of transmission of

productive qualities to the offspring (Lapina, 2009) (Table 3).

As it can be seen from the data in table 3, the parental index of cows (PIC) for the milk yield of first- heifer cows of the Jersey breed was 7881 kg of milk, for the fat content - 5.82%.

Table 3. Realization of the genetic potential of first-heifer cows

Indicii		X \pm Sx
Parental index of cows (PIC)	milk yield, kg	7881 \pm 214.6
	fat, %	5.82 \pm 0.07
Own productivity of first-heifer cows	milk yield, kg	4660 \pm 30.6
	fat, %	5.96 \pm 0.03
Realization of genetic potential (RGP), %	milk yield, kg	59.1
	fat	102.4

The realization of the genetic potential (RGP) for milk yield in 305 days of lactation was 59.1%.

The realization of the genetic potential in terms of fat content was high and amounted to 102.4%.

Exterior is part of the assessment and an important aspect in the breeding of dairy cattle, characterizes the breed, and gives it certain characteristics that distinguish it from other breeds.

The desired type influences not only the level of development of individual signs of the exterior,

but also characterizes their most appropriate ratio, which is achieved by directed choice and selection of animals.

Exterior assessment was carried out visually and by taking the main body measurements (Table 4, Figure 1).

As it can be seen from the data presented, all major measurements for Jersey first- heifer cows are within the limits established by the target standards. So, the height at the withers averaged 126.0 cm, the height at the sacrum - 131.1 cm.

Table 4. Indicators of linear measurements of body figure of first-heifer cows, cm ($X \pm Sx$)

Measurements	Indices		
	$X \pm Sx$	σ	Cv
Height at withers	126.0±0.4	2.75	2.18
Height at the sacrum	131.1±0.5	3.27	2.44
Chest depth	63.7±0.5	3.11	4.88
Chest width behind shoulder blades	40.5±0.4	2.44	6.02
Width in hook bone	45.0±0.3	1.97	4.37
Width at the hip joints	27.8±0.3	1.87	6.72
Oblique body length	150.8±0.5	3.28	2.17
Chest girth behind the shoulder blades	174.5±1.0	6.41	3.67
Pastern girth	16.6±0.1	0.51	3.06



Figure 1. Exterior of the first- heifer cows of the Jersey breed of the SLL "Topal-Bereket"

The chest is deep and wide and averaged 63.7 cm and 40.5 cm, respectively. The bone is thin - the pastern girth is 16.6 cm.

Analysing the results of the exterior assessment of first-heifer cows, it should be noted that they have a pronounced type of dairy cattle, which is confirmed by a proportional body shape.

The head is small, light, with a concave profile and a wide forehead. The neck is thin, with many small folds of skin. The back with slack, the dewlap is small, the body is somewhat stretched, with angular forms of constitution and a raised tail root, the muscles are poorly developed. The limbs are well developed, strong, the hoof is short, well rounded with a

deep back wall and an even sole, the pasterns are strong, flexible, the hocks are clearly defined, good shaped, not rough, dry.

All evaluated animals showed the type characteristic to the Jersey breed, which is also confirmed by the index score (Table 5).

The index of high legs in first-heifers of the Jersey breed of the SLL "Topal-Bereket" herd averaged 49.4%, which characterizes the good development of the organism in the postnatal ontogenesis of animals. The index of high legs in first-heifers of the Jersey breed of the SLL "Topal-Bereket" herd averaged 49.4%, which characterizes the good development of the organism in the postnatal ontogenesis animals.

Table 5. Physique indices of first-heifer cows of Jersey breed, %

Indexes	Indices	Standard for breeds of different directions of productivity		
		Dairy	Meat	Dairy and Meat
Highlegs	49.4	45.7	42.2	48.2
Lengthiness	119.7	120	122	118.4
Pelvic	90	80.2	83.5	85.5
Chest	63.6	61.8	79.6	68.8
Consistency	115.7	118.0	132.5	121.3
Overgrown	104.0	100.9	103.2	102.5
Osseous	13.2	14.6	13.9	15.4

The stretch index, or format, is inherent to dairy cattle with the best exterior quality characteristics. As evidenced by the values of the indicators of our research, at first- heifers of the Jersey breed, the lengthiness index is 119.7%, which is by 0.3% less than the standard for dairy breeds. The pelvic and chest indices are by 9.8 and 1.8 units higher than the standard for breeds of dairy productivity.

The general development of the body and body weight can be judged by the consistency or compact index. It should be noted that the first-heifers of Jersey breed is characterized by a compact physique with a consistency index of 115.7%, which is peculiar to them in the studied period of development.

The ratio of the height at the sacrum to the height at the withers is characterized by the overgrowth index, which is a good indicator of the growth and development of the organism in the postembryonic period. The average indicator of our studies of this index (104.0%) testifies to the good development of the physique of the

evaluated animals. The bone index was lower than the standard for dairy breeds (1.4%), while the proportions of the physique of the animals of the evaluated Jersey heifers were preserved.

Thus, the results of the visual and index assessment showed that the first Jersey heifers had a pronounced milk type. They are characterized by a good physique and a strong constitution, on which the level of milk production, health status and the duration of productive exploitation largely depend.

Assessment of the udder of cows is one of the most important measures of technological selection of cows and is carried out in order to determine the suitability of animals for machine milking, its development is characterized by measurements of the udder and teats of first-heifers.

Measurement indicators, which are given in Table 6, characterize the development of morphological features of the udder in first- heifers of the Jersey breed of the SLL "Topal-Bereket" herd.

Table 6. Morphological properties of the udder of first-heifer cows of Jersey breed

Signs	Indices		Points
	X±Sx	Cv	
<i>Udder size, measurements, cm</i>			
Girth	125.8±0.5	2.8	5
Length	32.0±0.3	6.6	5
Width	37.9±0.6	9.8	5
Depth	23.7±0.3	7.3	4
Distance from the bottom of the udder to the ground	60.4±0.2	6.1	-
<i>Size of nipples, cm</i>			
Front nipple length	5.30±0.06	7.9	4
Back nipple length	4.4±0.03	4.1	-
Front nipple diameter	2.6±0.04	10.3	5
Back nipple diameter	2.3±0.02	6.6	-
<i>Distance between nipples, cm</i>			
front	9.0±0.03	20.5	
back	6.2±0.1	15.6	
front and back	10.8±0.2	12.9	
<i>Udder shape:</i>			
tub-shaped – 67.4 %; cup-shaped – 32.6 %			

From the given data it follows that the first-calf heifers of SLL "Topal-Bereket" in terms of measurements, the girth, length and width of the udder correspond to the permissible norm and the requirements of the standard for the Jersey breed. The udder girth is large; the depth is medium. The length of the front nipples was within 5.3 ± 0.06 cm, the back - 4.4 ± 0.03 cm. The diameter of the nipples both front (2.6 ± 0.04 cm) and back (2.3 ± 0.02 cm) and the teat spacing was in a standard milking position. The distance from the bottom of the udder to the ground was within the permissible norm - 60.4 ± 0.2 cm. All evaluated first-heifers of the Jersey breed had the desired udder shape (tub-shaped - 67.4% and cup-shaped - 32.6%), the development of the udder quarters was symmetrical, uniform, tight attachment to the body, the bottom of the udder is horizontal, the shape of the nipples is cylindrical (Figure 2).

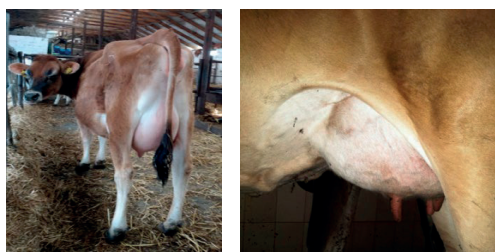


Figure 2. The shape of the udder and teats of first-heifer cows of Jersey breed

Characterizing the variation of the udder measurement indices, it can be noted that to the least variability are subjected measurements of

the udder of first-heifer cows by girth - 2.8%; by distance from the bottom of the udder to the ground - 6.1%; along the length of the nipples - 7.9% (front) - 4.1% (back); on the diameter of the nipples - 10.3% (front) - 6.6% (back).

Low coefficients of variation indicate a targeted selection of cows with excellent udder quality. On average for the herd, the coefficients of variation show that this herd of first-heifer cows is the most variable in terms of the distance between the teats - the front teat is 20.5%, the back teat is 15.6%.

When selecting for any complex physiological indicators, it is necessary to establish the degree and direction of the relationship with other indicators. If there is a positive correlation between the sectioned indicators, then the selection of animals for one indicator automatically leads to an improvement of another indicator.

The relationship of morphological signs of the udder and milk yield for 305 days of lactation of first-heifer cows can be judged by studying the correlations, the results of which are given in Table 7.

Between the girth and width of the udder and milk yield per lactation of Jersey first-heifer cows, the relationship is weak positive and is 0.092 and 0.102, respectively. The correlation between the length, width and girth of the udder and the fat content in milk is weak and amounts to +0.123, +0.053 and +0.158, respectively. The weak link between udder measurements and signs of milk production is a consequence of drought, which affected cow feeding levels in 2020 and affected milk yield per lactation.

Table 7. Correlations between udder measurements, milk productivity of first-heifer cows of Jersey breed, $r \pm m_r$

Udder measurements	Correlation coefficient		
	milk yield for 305 days of lactation	fat content	amount of fat
Length	-0.064	+0.123	-0.004
Width	+0.092	+0.053	-0.062
Girth	+0.102	+0.158	+0.213
Front lobe depth	-0.071	-0.005	-0.003

CONCLUSIONS

The milk yield of first-heifer cows for the first lactation averaged 4660 kg of milk with a fat content of 5.96%, the amount of milk fat - 276 kg.

All basic measurements of first- heifers of Jersey breed are within the limits established by

the target standards: height at the withers averaged 126.0 cm, height at the rump - 131.1 cm, deep and wide chest - 63.7 cm and 40.5 cm, respectively, the skeleton is thin – the pastern girth is 16.6 cm.

It has been established that first-heifers of Jersey breed are characterized by a compact physique with a consistency index of 115.7%, which is

characteristic of them in the studied period of development.

All evaluated Jersey heifers had the desired udder shape (tub-shaped - 67.4% and cup-shaped - 32.6%).

The correlation between the length, width and girth of the udder and the fat content in milk is weak and amounts to +0.123, +0.053 and +0.158, respectively.

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