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INFLUENCE OF DIRECTED SELECTION BY MILK PRODUCTIVITY OF HORSES OF THE RUSSIAN HEAVY BREED ON THE FORMATION OF THE EXTERIOR

ANNOTATION

The studied population of Russian draft mares of the milking herd of the breeding kumys complex of the ZAO PZ Semenovsky breeding plant of the Republic of Mari El has high milk productivity, formed as a result of a long-term (over a period of more than 40 years) directed selection. During the period from 1982 to 2022, at the breeding kumys complex, 8 generations of mares of the Russian heavy breed were obtained, in which, due to the direction of selection work, changes in the exterior characteristic of dairy cattle occurred. Growth measurements (height at the withers and height of the leg at the elbow) increased slightly - by an average of 0,4 %. Chest girth decreased significantly - by 9,8 cm* and chest width - by 2,0 cm* (*The difference turned out to be significant and reliable P≥0,99). The physique of dairy mares became less massive, but at the same time increased in length by 1,7 % and became more angular - the depth of the chest increased by 1,09 %. In addition, in mares of the studied population, there was an increase in the length and width of the croup - by 1,06 and 0,7 %, respectively, as well as in the girth of the pastern - by 1,89 %. As a result, as a result of breeding work, in mares there was a decrease in the indices of flatness (chest girth) and compactness by 5,1 and 6,4 %, respectively, while the indices of format, chest depth and pastern girth increased by 1,3 - 0,6 – 2,1 percent. This fact makes it possible to form a dairy type in the population of horses of the Russian heavy draft breed of the kumys breeding complex of ZAO PZ Semenovsky.

Key words: *Russian draft horse breed, selection for milk production, assessment of exterior by measurements, body build indices, milk type.*

Introduction. In 1982, a koumiss farm was built in the Republic of Mari El at the Ovoshchevod state farm in the Medvedevsky district. To complete the livestock, horses of three heavy breeds were brought to the enterprise - Lithuanian, Russian and Soviet. They served as the starting point for this study. The ideological inspirer of the development of a new direction for the Republic of Mari El - dairy horse breeding, was Professor of the Mari State University V. S. Yavorsky. His research served as the basis for the development of intensive dairy horse breeding technology (1988). In the research materials of V.S. Yavorsky [13, 14] gives characteristics of the horses of the Russian heavy draft breed of the first generation, as well as the basic principles in accordance with which the farm was

staffed. The main feature of the horses brought to Mari El was that the selection of animals was carried out by appearance, since there were no clear criteria for selecting high-milk mares of heavy breeds into milking herds. The mares selected for the kumys farm were distinguished by their strong constitution, relatively large stature and massive physique. The mares had a harmonious, dry, small head; short, well-muscled neck; long, sometimes slightly soft back; flat, wide loin, wide, long and well-formed croup; correctly positioned strong limbs. All horses brought to the farm were aged from 1 to 7 years, had never been in the conditions of dairy horse breeding technology and were not used to produce marketable milk. In 1987-1988, replacement young stock from among the mares born here began to be introduced into the milking herd of the kumys farm, and 2nd generation mares appeared. That is why, in our research, we consider the starting point not to be the year the horses were brought to the farm, but 1986. Using horse assessment materials for 1986, we got an idea of the exterior of the mares - the founders of the koumiss farm, as well as their productive qualities.

Characteristics of the kumys farm population for 2000 were obtained from the research of A.V. Onegov [9], who in 1998-2001 studied the influence of types of higher nervous activity on milk production in heavy breed horses. During this period of time, targeted selection for milk productivity had been carried out at the koumiss complex for almost 18 years, and 3rd and 4th generations of Russian draft horses appeared.

The next stage of breeding work is reflected in the works of E. D. Chirgin "Zootechnical principles of intensifying the production of mare's milk on stationary koumiss farms" (2008-2019) [7, 8]. During this period of time, mares of 5 and 6 generations appeared in the milking herd, and therefore, the grading data for 2011 was used as the reporting period.

In 2022, the milking herd of the breeding koumiss complex consisted mainly of mares of 7 and 8 generations from the ancestors who were once imported. We carried out an assessment based on measurements of 68 milking mares of the Russian draft breed available as part of a milking herd. The results of the research - the dynamics of changes in the measurements of mares of the Russian draft breed over the years of targeted selection for milk productivity and trend lines are presented in Figures 1-9.

It should also be noted that over the more than forty-year period of the farm's existence, the animals were in almost identical conditions of keeping, feeding and breeding, and the main feature of selection during selection and breeding work was milk productivity.

The purpose of the work is to conduct a comparative assessment based on measurements and physique indices of different generations of mares of the Russian draft breed, which are in conditions of intensive dairy horse breeding technology. As a result of targeted selection for milk production over a period of more than forty years, the mares of the studied population developed not only the highest genetic potential for milk production, but also distinctive features in the exterior characteristic of high-milk animals. Thus, as a result of long-term selection of horses, university scientists and specialist breeders of the farm have come close to the need to register a selection achievement - the formation of a dairy type of horse of the Russian draft breed.

Material and methods. The research material included data from the primary zootechnical records of horses at the kumys farm (breeding kumys complex), cards of brood mares, state stud books of horses of the Russian heavy breed, as well as the results of the grading of horses for the period from 1982 to 2022.

Measurements were taken in accordance with the instructions for grading horses with an accuracy of 1 cm, and the girth of the pastern - with an accuracy of 0.5 cm. To take measurements from mares of the Russian heavy breed of the milking herd of the breeding koumiss complex, the main measuring instruments were used: a measuring stick, a compass and tape. The height at the withers was determined with a measuring stick as the vertical distance from the highest point of the withers to the ground. The length of the body was also measured with a stick, as the distance from the shoulder-scapula joint to the ischial tuberosity. Chest girth was determined using a tape - as the distance from the highest point of the withers tangentially to the posterior corner of the shoulder blade to the base of the sternum and back to the highest point of the withers. Metacarpal girth was determined using a tape at the narrowest point of the metacarpus (the lower part of the upper third of the metacarpus). The height of the leg at the elbow is determined by the tape as the vertical distance from the elbow to the ground. The depth of the chest was determined using a measuring stick as the vertical distance from the highest point of the withers to the base of the sternum, tangent to the posterior angle of the shoulder blade. The width of the chest was determined using a compass, as the distance between the outermost protrusions of the shoulder-scapular joints. To determine the width of the croup, a compass

was also used, calculating the distance between the croup. The length of the croup was determined as the distance from the croup to the ischial tuberosity.

Body physique indices were calculated using the following formulas:

$$Format\ index = \frac{Oblique\ length\ of\ the\ trunk}{Height\ at\ the\ withers} x100\% \quad (1)$$

$$Chest\ Girth\ index = \frac{Chest\ girth}{Height\ at\ the\ withers} x100\% \quad (2)$$

$$Compactness\ index = \frac{Chest\ girth}{Oblique\ length\ of\ the\ trunk} x100\% \quad (3)$$

$$Chest\ Depth\ index = \frac{Chest\ depth}{Height\ at\ the\ withers} x100\% \quad (4)$$

$$Long - legged\ index = \frac{Height\ of\ the\ leg\ at\ the\ elbow}{Height\ at\ the\ withers} x100\% \quad (5)$$

$$Index\ of\ pastern\ girth = \frac{Pastern\ girth}{Height\ at\ the\ withers} x100\% \quad (6)$$

To carry out a comparative description of the measurements and physique indices of the horses, the study population was divided into four groups in accordance with their belonging to the corresponding generations: the first group - ancestral mares brought to the farm in 1982; second group – mares of the third and fourth generations; third group – mares of the fifth and sixth generations; fourth group – mares of the seventh and eighth generations. The obtained materials were subjected to statistical processing in the EXCEL program.

Research results and discussion. To study the influence of targeted selection for milk production in the studied population of Russian draft horses, we took 9 measurements (height at the withers, body length, chest girth, metacarpus girth, leg height at the elbow, chest depth, chest width, croup width and croup length) and carried out statistical processing of data in accordance with the affiliation of mares to different generations of animals at the complex.

The dynamics of changes in height at the withers in mares of the Russian draft breed over the years of targeted selection for milk production and the trend line are presented in Figure 1.

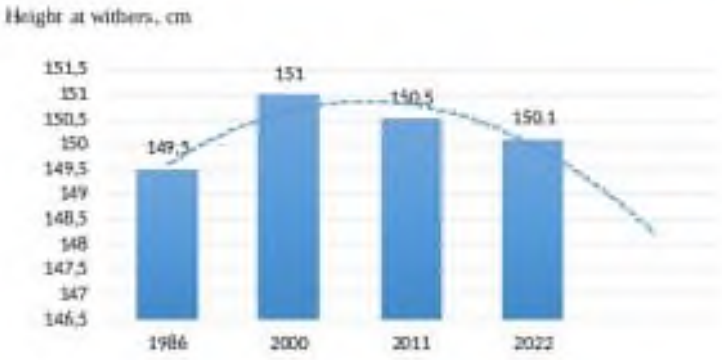

Figure 1 – Dynamics of changes in height at the withers in mares of the Russian draft breed over the years of targeted selection for milk production and the trend line

The materials in the figure indicate that at the initial stage, during selection for the milking herd, larger individuals were selected, which, as a rule, had a higher milk production. This direction of selection led to an increase in the height at the withers of mares by the 3rd-4th generation (2000) by 1.5 cm or almost 1%. Subsequently, the height of horses began to decrease slightly: in 20011 (5-6 generation) it averaged 150.5 cm, and in 2022 (7-8 generation) it averaged 150.1 cm. This, in our opinion, is due to the fact that in conditions intensive technology, milk productivity began to be influenced to a greater extent by the genetics and adaptive abilities of animals rather than the size of the lactating uterus. The trend line also indicates stabilization of the trait due to targeted selection for milk productivity. A similar picture is observed with another height measurement – the height of the leg at the elbow (Figure 2).

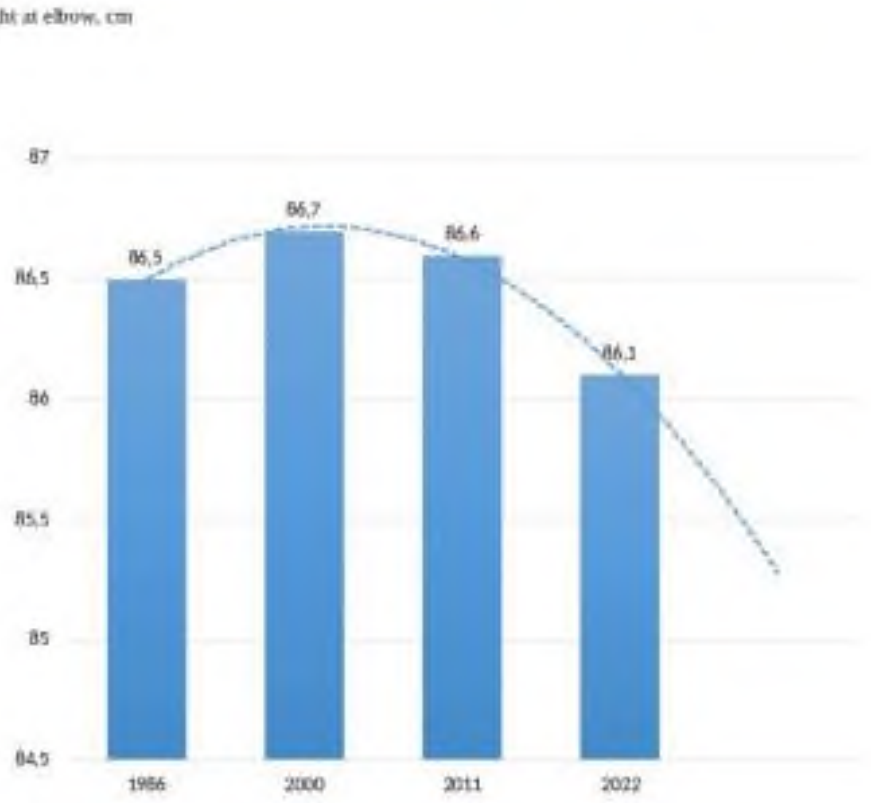

Figure 2 – Dynamics of changes in leg height at the elbow in mares of the Russian draft breed over the years of targeted selection for milk production and the trend line

A slightly different picture was observed when studying the dynamics of changes in chest girth and chest width (Figures 3 and 4).

As a result of targeted selection for milk productivity in mares by 2022 (7th-8th generation), compared with their ancestors (1986 1st generation), chest girth decreased by 4.75%* and chest width by 4.29%*. (*The difference turned out to be significant and significant P≥0,99). These changes in the exterior of animals are due to the fact that in dairy horse breeding there is no heavy load on the muscular system of horses and the powerful development of the chest and lungs is not required at all. It should also be noted that the physique of richly milking mares gradually became less massive, but at the same time increased in length, acquiring a certain elongation.

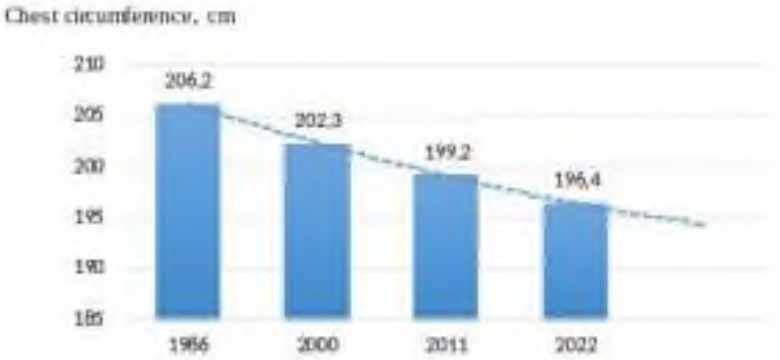

Figure 3 – Dynamics of changes in chest girth in mares of the Russian draft breed over the years of targeted selection for milk production and the trend line

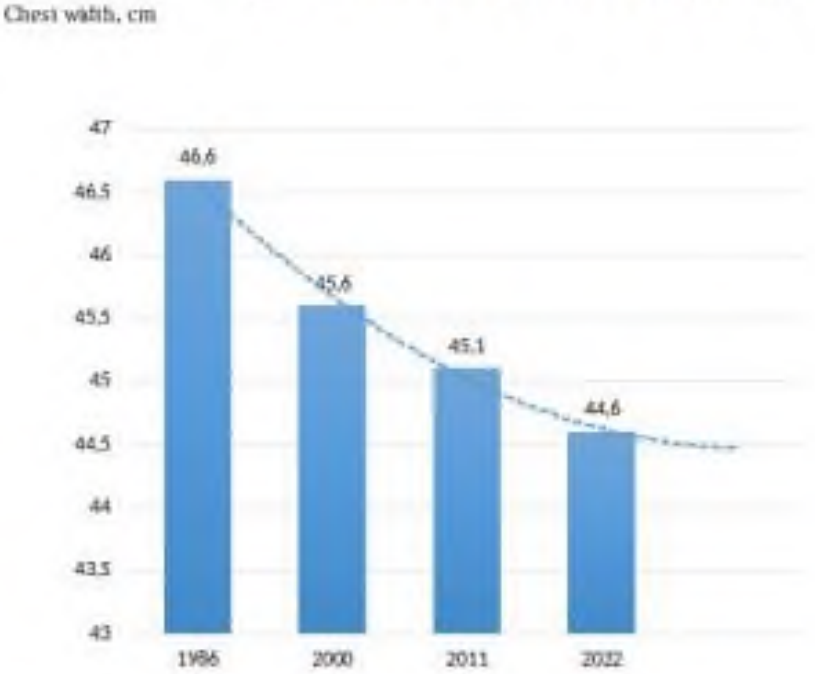

Figure 4 – Dynamics of changes in chest width in mares of the Russian draft breed over the years of targeted selection for milk productivity and the trend line

The dynamics of changes in body length in mares of the Russian draft breed over the years of targeted selection for milk production and the trend line are presented in Figure 5.

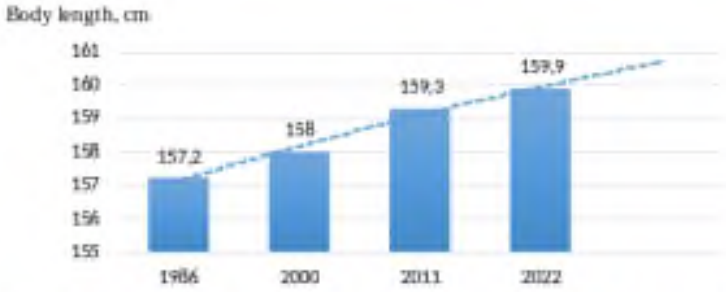

Figure 5 – Dynamics of changes in body length in mares of the Russian draft breed over the years of targeted selection for milk productivity and the trend line

The presented materials indicate a trend of increasing body length during selection for milk productivity. Thus, the body length of mares, due to targeted selection, increased in the 7th-8th generation of mares by an average of 2.7 cm, which amounted to 1.7%. A similar picture was observed with the development of chest depth (Figure 6).

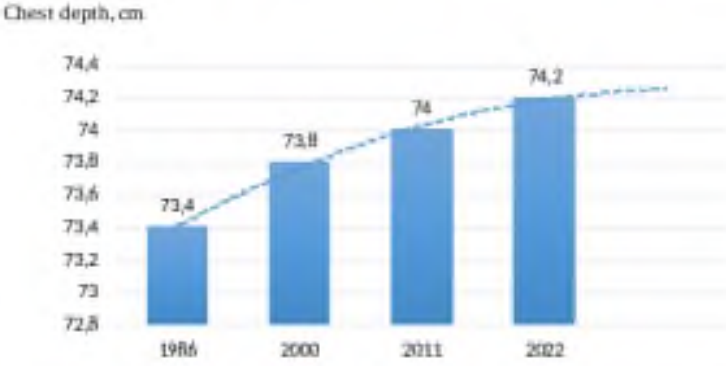

Figure 6 – Dynamics of changes in chest depth in mares of the Russian draft breed over the years of targeted selection for milk production and trend line

As a result of targeted selection for milk productivity, the chest depth in mares of the Russian draft breed increased from 73.4 cm in 1986 to 74.2 cm in 2022, which amounted to 1.09%. An increase in chest depth with a decrease in chest girth is precisely what gives mares the "angularity" characteristic of highly productive cattle.

The dynamics of changes in the width and length of the croup in mares of the Russian draft breed over the years of targeted selection for milk productivity are presented in Figures 7 and 8.

The development of the croup (its width and length) in mares is usually associated with reproductive qualities, since a wide and long croup indicates good development of the reproductive organs, as a result of possibly lighter foals. In addition, an increase in the linear measurements of the croup may indirectly indicate an increase in the mare's udder, which is associated with the growth of secretory tissues of the mammary gland due to intensive milking. Studies have shown that in the period from 1986 to 2022, mares increased slightly: the width of the croup - by 0.7% (0.4 cm) and the length of the croup - by 1.06% (0.6 cm).

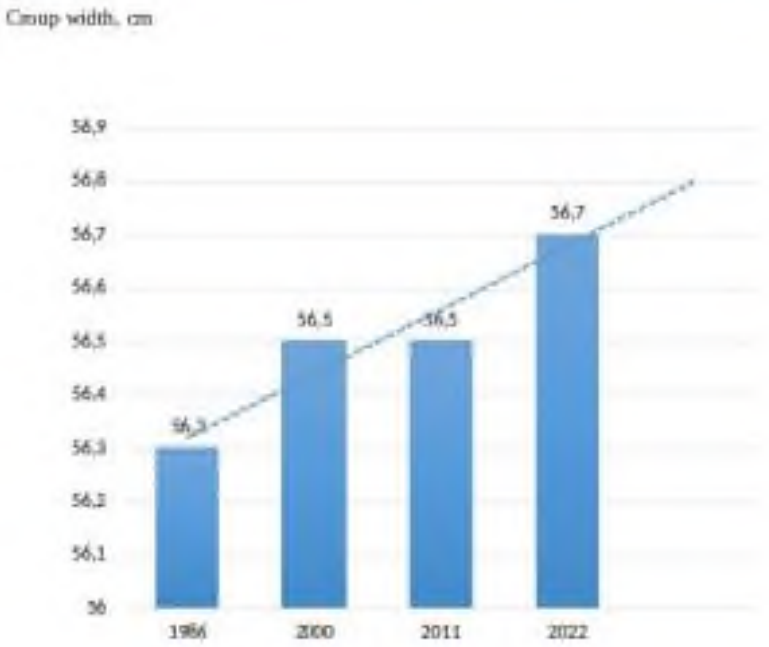

Figure 7 – Dynamics of changes in croup width in mares of the Russian draft breed over the years of targeted selection for milk productivity and trend line

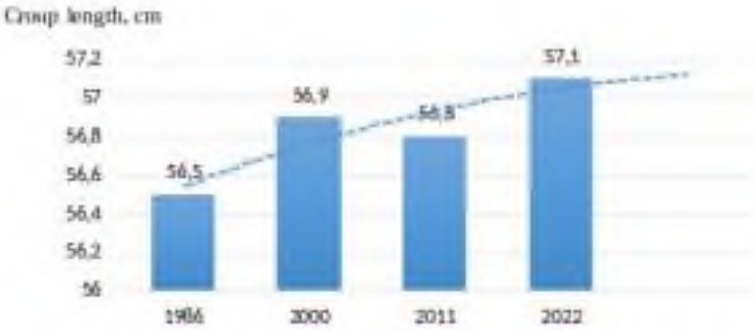

Figure 8 – Dynamics of changes in croup length in mares of the Russian draft breed over the years of targeted selection for milk productivity and trend line

The dynamics of changes in pastern girth in mares of the Russian draft breed over the years of targeted selection for milk production are presented in Figure 9.

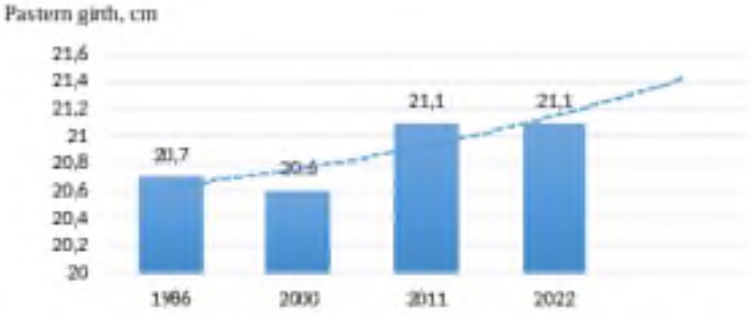

Figure 9 – Dynamics of changes in pastern girth in mares of the Russian draft breed over the years of targeted selection for milk production and trend line

It follows from the figure that in mares, as a result of long-term selection for milk productivity, an increase in pastern girth is observed - by 1.89%. This fact, in our opinion, is due to the development of the skeletal system - as the main calcium depot. High milk productivity implies a large removal of calcium from the body with milk yield, which is why the skeletal system of horses develops.

To confirm our opinion about changes in the body proportions of mares, we calculated body indices at the same time intervals as the measurements, and presented the information obtained in the table.

Table - Dynamics of changes in body indices in mares of the Russian draft breed over the years of targeted selection for milk production

Index	Years (generation of mares)			
	1986 (1)	2000 (3-4)	2011 (5-6)	2022 (7-8)
Format, %	105,1	104,6	105,8	106,5
Chest circumference, %	137,9	133,9	132,4	130,8
Compactness, %	131,2	128,0	125,0	122,8
Chest depth, %	49,1	48,9	49,2	49,4
Long-legged, %	57,9	57,4	57,5	57,4
Pastern girth, %	13,8	13,6	14,0	14,1

From the table it follows that long-term selection for milk productivity led to a decrease in the indices of roundness (chest girth) and compactness by 5.1 and 6.4%, respectively (due to a decrease in chest girth and width). At the same time, there was an increase in the format index - by 1.3% (due to an increase in body length and a decrease in height at the withers), chest depth index - by 0.6% (due to an increase in chest depth and a decrease in height at withers) and a metacarpus girth index – 2.1% (due to an increase in the girth of the pastern and a decrease in the height at the withers).

Conclusion. As a result of the conducted research, it was established that targeted selection for milk productivity had an impact on the formation of the exterior characteristics of the mares of the milking herd of the breeding koumiss complex of the Semenovsky breeding plant CJSC. Growth measurements (height at the withers and height of the leg at the elbow), having slightly increased in animals of the 3rd-4th generation - by 1%, subsequently stabilized and even began to decrease slightly: by 0.3 and 0.6%, respectively, in the 5th-6th and 7th generations -8 generations. At the same time, a comparison of the growth measurements of the uterus of the ancestors and mares of the 7th-8th generation showed a slight superiority of the latter - by 0.4%. The absence of loads on the muscular system of horses led to the fact that in mares of the 7th-8th generation, compared with their ancestors, the chest girth significantly decreased - by 4.75% and chest width - by 4.29%. The body of heavily milked mares became less massive, but at the same time increased in length by 2.7 cm or 1.7% and became more angular - the depth of the chest increased by 1.09%. In addition, in mares of a milking

herd there is an increase in the linear measurements of the croup (its length and width) and the girth of the pastern. This fact, in our opinion, is due not only to the development of the organs of the reproductive system, but also the udder, as well as the skeletal system (the main calcium depot).

Thus, as a result of long-term selection, mares of the Russian draft breed with a high level of milk productivity have developed distinctive exterior features characteristic of dairy cattle. This fact makes it possible to form a dairy type of horse in the Russian draft breed.

Similar results were obtained in studies by a number of scientists on mares of local horse breeds. Thus, A.M. Allaguzhin [1], Yu.N. Barmintsev [2, 3], L.A. Saigin [6] recommended using a moderately wide body, elongated body and long croup as signs of high milk production in local mares.

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ТҮЙІН

Марий Эл Республикасы Семеновск асыл тұқымды зауыты ЖАҚ асыл тұқымды қымыз кешенінің сауын табынының ресейлік шалғын биелерінің зерттелген популяциясы ұзақ мерзімді (40-тан астам кезеңде) нәтижесінде қалыптасқан сүт өнімділігі жоғары. жылдар) бағытталған іріктеу. 1982-2022 жылдар аралығында асыл тұқымды қымыз кешенінде орыстың ауыр тұқымды биелерінің 8 ұрпағы алынды, оларда селекциялық жұмыстардың бағытына байланысты сүтті малдың сыртқы сипаттамасында өзгерістер орын алды. Өсу өлшемдері (шұңқырдағы биіктік және шынтақтағы аяқтың биіктігі) аздап өсті - орта есеппен 0,4%. Кеуде қуысының көлемі айтарлықтай төмендеді - 9,8 см* және кеуде ені - 2,0 см* (*Айырмашылық маңызды және сенімді P≥0,99 болып шықты). Сауын биелердің дене бітімі азырақ массивті болды, бірақ сонымен бірге ұзындығы 1,7% -ға ұлғайып, бұрыштық болды - кеуде тереңдігі 1,09% -ға өсті. Сонымен қатар, зерттелетін популяцияның биелерінде қырқының ұзындығы мен ені сәйкесінше 1,06 және 0,7%-ға, сондай-ақ балауыздың ені 1,89%-ға ұлғайған. Нәтижесінде, асыл тұқымды жұмыстардың нәтижесінде биелерде жазықтық (кеуде аймағы) және ықшамдылық көрсеткіштері сәйкесінше 5,1 және 6,4%-ға төмендесе, формат, кеуде тереңдігі және қойнаулық қоршау көрсеткіштері 1,3-ке өсті. - 0, тиісінше ,6 - 2,1 пайыз. Бұл факт П.З.Семеновский атындағы ЖАО қымыз өсіру кешенінің ресейлік ауыр жылқы тұқымының жылқыларының популяциясында сүтті типті қалыптастыруға мүмкіндік береді.

РЕЗЮМЕ

Исследуемая популяция русских тяжеловозных кобыл дойного табуна племенного кумысного комплекса ЗАО племенной завод «Семеновский» Республики Марий Эл обладает высокой молочной продуктивностью, сформированной в результате длительной (за более чем 40 летний период) направленной селекции. За период с 1982 по 2022 годы на племенном кумысном комплексе получены 8 поколений коневаток русской тяжеловозной породы, у которых вследствие направления селекционной работы произошли характерные для молочного скота изменения в экстерьере. Ростовые промеры (высота в холке и высота ноги в локте) увеличились незначительно – в среднем на 0,4 %. Значимо уменьшились обхват груди - на 9,8 см* и ширина груди - на 2,0 см* (*Разница оказалась значительной и достоверной P≥0,99). Телосложение дойных кобыл стало менее массивным, но при этом увеличилось в длину на 1,7% и стало более угловатым - глубина груди возросла на 1,09%. Кроме того, у кобыл исследуемого поголовья произошло увеличение длины и ширины крупа – соответственно на 1,06 и 0,7%, а также обхвата пясти – на 1,89%. Как следствие, у кобыл в результате селекционной работы произошло уменьшение индексов сбитости (обхвата груди) и компактности соответственно на 5,1 и 6,4%, в то время как индексы формата, глубины груди и обхвата пясти увеличились соответственно на 1,3 - 0,6 - 2,1 процентов. Данный факт позволяет сформировать в популяции лошадей русской тяжеловозной породы племенного кумысного комплекса ЗАО ПЗ «Семеновский» молочный тип.

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CONTENT

ANIMAL HUSBANDR

Chirgin E. D., Onegov A.V., Semenov V.G., Shamshidin A.S., Baimukanov D.A.
INFLUENCE OF DIRECTED SELECTION BY MILK PRODUCTIVITY OF HORSES OF THE RUSSIAN HEAVY BREED ON THE FORMATION OF THE EXTERIOR..... 3
Chirgin E.D., Onegov A.V., Semenov V.G., Shamshidin A.S., Baimukanov D.A., Bayazitova K. N.
THE CONNECTION OF THE EXTERIOR OF THE MARES OF THE RUSSIAN HEAVY-DRAFT BREED WITH THEIR DAIRY PRODUCTIVITY..... 13
Yessengaliev K. G., Kassimova G. V., Kozhakhmetova A .N.
THE USE OF SHEEP PRODUCERS OF THE AKZHAIK MEAT AND WOOL BREED TO IMPROVE THE MEAT PRODUCTIVITY OF FINE-FLEECED SHEEP..... 21
Sainova G. A, Yessenbayeva Zh. Zh., Akhasova A. D., Yuldashbek D. H.
STUDY OF THE EFFECT OF PROTEIN-VITAMIN-MINERAL FEED ADDITIVES ON THE INCREASE IN LIVE WEIGHT OF HORSES..... 28
Kozhahmetova A.N., Murat B. K., Aleidar S. A., Baimukanov A. D.
EFFECTIVE TECHNOLOGIES IN DAIRY CATTLE BREEDING..... 36

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