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Monitoring of Reproductive Capacity of Dairy Cattle in Eurasia: A Comparative Study in Kazakhstan and the Republic of Tuva

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Abstract: This study investigates the reproductive capacity of dairy cattle populations in the Republic of Kazakhstan and the Republic of Tuva (Russian Federation). Experimental work was conducted at four study sites: in Kazakhstan, Abdrakhmanov Bolat Dauletbekovich SP (Akmola region) and Alimzhanov TS farm (Almaty region); in the Republic of Tuva, Oyun SP of Kyzyl district (forest-steppe population) and SPK Breeding Farm Bai-Dag of Erzin district (dry-steppe population). Results revealed that actual herd reproduction parameters in Kazakhstan deviated from standard indicators: service period exceeded norms by 5-65 days, insemination index ranged 0.8-1.3 doses (standard: 1 dose), and age at first insemination varied by 1-4 months from recommended values. In the Republic of Tuva, service period duration averaged 90.7 days for forest-steppe populations and 97.3 days for dry-steppe populations. Reproductive capacity coefficients for local Tuvan cattle were 0.99 (forest-steppe) and 0.93 (dry-steppe). Gynecological monitoring identified ovarian dysfunction frequencies of 3.5-6.9% (hypofunction) and 2.9-6.7% (follicular cysts). Biochemical blood analyses revealed all parameters within physiological normal ranges, indicating adequate nutritional status. These findings provide baseline reproductive performance data for local dairy cattle breeds in Central Asian environments, informing breeding strategies and herd management practices for indigenous cattle populations adapted to regional climatic conditions.

Keywords: Dairy Cattle, Reproductive Performance, Local Breeds, Indigenous Cattle, Kazakhstan, Republic of Tuva, Ovarian Dysfunction, Service Period, Breed Conservation

Introduction

Conservation of indigenous dairy cattle breeds represents a critical research priority in Central Asian livestock systems. However, maintaining viable populations of local breeds remains challenging without sustained governmental support and strategic breeding programs (Clasen et al., 2021; Yelemesov &

Baimukanov, 2020; Baimukanov, 2021; Semenov et al., 2020, 2021). When developing breeding strategies for local livestock, comprehensive assessment of reproductive characteristics is essential for ensuring population sustainability (Asfaw et al., 2021).

Enhancing the efficiency of selection and breeding programs in dairy cattle production constitutes a key priority for improving industry competitiveness (Raketsky et al., 2021). Implementation of modern breeding methodologies, including genetic and genomic evaluation, will facilitate development of cattle populations adapted to diverse regional conditions throughout Kazakhstan while maintaining productive traits such as milk yield, milk fat content, milking flow rate, and machine milking adaptability (Yelemesov & Baimukanov, 2020).

A fundamental condition for dairy cattle development in Kazakhstan and globally remains the qualitative improvement of existing breeds through flexible breeding programs responsive to evolving market conditions, a factor largely determining milk production profitability (Baimukanov et al., 2021). During the current intensification phase of dairy production, breed selection assumes decisive importance (Baimukanov et al., 2024b).

Local cattle breeds exhibit adaptations to extensive grazing systems, necessitating selection emphasis on traits enhancing calf production and survival rates. Consequently, genetic improvement of indigenous cattle populations represents a continuous process requiring sustained attention (Alilo, 2019). The influence of breed on milk composition under equivalent environmental conditions has been well documented (Kebede, 2018).

Investigation of selection traits across diverse indigenous livestock populations contributes to enhanced sustainability of efficient livestock management systems (Marchioretto et al., 2023). However, crossbreeding local cattle with commercial breeds poses extinction risks to indigenous genetic resources, a concern increasingly relevant across many countries (Sutarno, 2016). Genetic improvement of local breeds requires comprehensive knowledge of genetic variation and productivity parameters (Mam et al., 2022; Voitenko et al., 2021).

Dairy productivity and fertility in modern cattle populations depend substantially on metabolic efficiency (Sammad et al., 2020), while management practices and nutrition exert significant influence relative to inherent breed characteristics (Clasen et al., 2020). Indigenous local breeds may be considered most closely related to "natural" or "wild" Bos genotypes (Myburgh et al., 2020), with milk composition and quality substantially determined by livestock genotype (Liu et al., 2024).

Local cattle breeds demonstrate superior adaptation to harsh climatic conditions while maintaining productive milk yields on natural pasture-based systems (Skager, 2022). Indigenous breeds often produce milk with lower fat content but elevated protein ratios, a characteristic common across many local livestock genotypes (Göncü et al., 2024).

Utilization of breeding value data encompassing multiple traits enables systematic genetic improvement of populations (herds) focused on enhancing milk or meat productivity while improving fertility parameters. Development and refinement of breeding programs for domestic dairy cattle breeds assumes particular importance, explaining the relevance of this research.

The objective of this study is to monitor reproductive capacity of dairy cattle in the Republic of Kazakhstan and the Republic of Tuva (Russian Federation), providing baseline data to inform breeding strategies and conservation programs for indigenous cattle populations adapted to Central Asian environmental conditions.

Materials and Methods

Study Location and Timeline

The research was conducted in the Republic of Kazakhstan and the Republic of Tuva (Russian Federation) during 2024.

Experimental Sites

The experimental component was conducted at four farm locations:

Republic of Kazakhstan:

- Abdrakhmanov Bolat Dauletbekovich SP, Akmola region
- Alimzhanov T.S. farm, Almaty region

Republic of Tuva:

- Oyun SP, Kyzyl district (representing forest-steppe population)
- SPC Breeding Farm "Bai-Dag," Erzin district (representing dry-steppe population)

Experimental Design

Formation of experimental cattle groups was performed according to standard zootechnical protocols (Baimukanov et al., 2024a).

Data Collection

Research materials comprised primary zootechnical and veterinary records, supplemented by experimental study results:

Dairy Productivity Analysis: Test milking procedures were conducted, with data supplemented by database downloads from the Republican Livestock System "Information and Analytical System."

Biochemical Blood Analysis: Samples were analyzed in accredited laboratories using automatic biochemical analyzers:

- HTI BioChem FC-120 "OLYMP VET" (Kokshetau, Kazakhstan)
- IP "Oranykhanov K.A." UNPC "Aibolit" (Almaty, Kazakhstan)

Reproductive Capacity Monitoring: The following parameters were assessed:

- Service period duration
- Fertility rate
- Insemination index
- Calf yield
- Inter-calving intervals

Gynecological Examination: Breeding stock at base farms underwent gynecological examination via rectal palpation to:

- Determine herd reproductive status
- Form experimental cow groups
- Investigate causes of infertility and breeding failure in herds of the southeastern region

Examinations followed established methodological protocols for gynecological assessment.

Estrus Cycle Characterization: Manifestation features, formation dynamics, excitation stages, and duration of estrus phenomena in dairy cows were studied. Cows were evaluated using biochemical blood parameters according to methodological guidelines for biological material collection for laboratory analysis.

Reproductive Capacity Coefficient Calculation

The reproductive capacity coefficient (RCC) was calculated using the following formula:

$$RCC = \frac{365}{ICP} \quad (1)$$

where:

- RCC = reproductive capacity coefficient
- 365 = average calendar year length (days)
- ICP = inter-calving period (days)

Statistical Analysis

Digital data processing was performed using standard statistical formulas with subsequent analysis following established biometric procedures (The Basics of Biometrics, 2011).

The technology of industrial milk production provides for uniform distribution of calving during the year and annual receipt of a calf from each cow. Meanwhile, in many farms of Kazakhstan, a significant reason for the decrease in the economic efficiency of dairy cattle breeding is the low indicator of the reproductive function of cows. Expanded reproduction of cattle and complete preservation of young animals are the main condition for the progressive development of the dairy cattle breeding, but this is hampered by a number of factors caused by diseases of the genital organs of females. These are puerperal endometritis, cervicitis, vaginitis, retention of placenta and other inflammatory diseases, and functional disorders - persistent corpus luteum, ovarian hypofunction of varying degrees, ovarian cysts, asynchronous ovulation.

It was established that the actual data on herd reproduction differed from the standard indicators. Deviations from the norm: according to the service period was 5-65 days, the 4th insemination index 0.8-1.3 doses; age at the time of the first insemination - 1-4 months (Table 1).

The duration of time from calving to the first insemination (waiting period) was 60 days, with the norm being 40-80 days.

The duration of the service period was 125-185 days, with the norm being 80-120 days.

The insemination index was 2.5-3 doses, with the norm 1.7.

The effectiveness of the first insemination was 33-40%, with the norm being 45-65%.

Table 1. Standards and actual data of the main indicators of herd reproduction in basic farms

Indicators	Recommended standard	Observed value (Alimzhanov TS Farm)	Observed value (Abdrakhmanov Bolat Dauletbekovich SP)
Interval from calving to first insemination (waiting period)	40-80 days	60 days	60 days
Service period	80-120 days	185 days	125 days
Insemination index	1.7 doses	3	2.5
First insemination success rate	45-65%	33%	40%
Abortion rate (45–265 days of gestation)	< 3%	5%	< 3%
Age at first calving	21-24 months	28 months	25 months

The age at the time of the first calving was 25-28 months, with the norm being 21-24 months.

According to the results of the obstetric-gynecologic medical examination of the dairy herd of 375 animals of the Holstein breed in the Alimzhanov T.S. farm, the number of ovarian dysfunction in the form of hypofunction and follicular cysts was 6.9 and 6.7%, respectively. Inflammation of the mucous membrane in the form of horn adhesion and uterine atony were detected in an average of 5.6% of the examined livestock, the main causes of which are the consequences of difficult calving and retention of the placenta. According to the results of obstetric-gynecological medical examination of the dairy herd in the amount of 312 animals of the Simmental breed in the sole proprietorship "Abdrakhmanov Bolat Dauletbekovich", the number of ovarian dysfunction in the form of hypofunction was 3.5% and follicular cysts 2.9%. Inflammation of the mucous membrane in the form of horn adhesion and uterine atony were detected in an average of 2.9% of the examined livestock (Table 2).

The frequency of ovarian hypofunction and inflammation of the uterine mucosa in first-calving cows in the farm "Alimzhanov T.S." is primarily associated with a decrease in the immune potential (resistance) due to stress during a difficult calving (in some cases, large-fruited), respectively, the presence of microtraumas of the uterine walls, the subsequent milking process and a sharp change in the feeding ration, i.e. the transition to a milking ration without a transit period. All these factors together lead to disorders that affect the lengthening of the intercalving period in first-calving cows.

Table 2. Monitoring of the gynecological states in cows on experimental farms

Indicators	Alimzhanov TS farm		Abdrakhmanov Bolat Dauletbekovich SP	
	n	%	n	%
Total animals examined	375	100	312	100
Pregnant cows (1–7 months of gestation)	146	39	140	45
Dry cows	33	8.8	37	11.8
Inseminated for less than 1 month.	124	33	106	33.9
Inflammation of the uterine mucosa	21	5.6	9	2.9
Follicular cyst	25	6.7	9	2.9
Ovarian hypofunction	26	6.9	11	3.5

The situation in reproduction in the Abdrakhmanov Bolat Dauletbekovich SP, where the number of Simmental cattle is slightly better and closer to the zootechnical norm. The appearance of cysts (follicular) in all basic farms is due to untimely or insufficient secretion of LH (luteinizing hormone) during the estrus due to the inability of the hypothalamic-pituitary system to adequately respond to estrogen stimulation through positive feedback mechanisms. The consequences of which lead to excessive secretion of fluid in the follicles, and is a fairly common dyshormonal pathology, leading to temporary infertility in most cases in dairy cows. At the same time, most cows recover without treatment in the period from 13 to 28 days, but in 35-40% of cases,

anovulatory cycles and cystic formations reappear. According to the results of our own research, functional ovarian disorder in the form of follicular cysts in high-milk herds is registered in up to 20% of cows in the production workshop.

In case of cystic formations in the ovaries, active treatment tactics are more rational than waiting for spontaneous recovery, which leads to an extension of the intercalving period. At the same time, during rectal examination and detection of signs of cysts, it was noted that 8-12 days after the initial diagnosis, treatment is required only for 50% of previously diagnosed animals. Also according to some researchers, active detection and treatment of cows with cystic formations of the ovaries is recommended based on multiple confirmation of the diagnosis.

In further research, a comprehensive study of this pathology is necessary, as well as improvement of diagnostics and methods of treatment of cows with functional disorders of the ovaries in the form of their cystic formations.

Biochemical blood tests showed that all the studied indicators were within the physiological norm. Table 3).

It is known that during the estrous cycle of cows, in most cases, two or three waves of follicle growth are observed. During each growth wave, a dominant follicle is formed, which differs from the subdominant ones by its larger size. During the ovulatory estrous cycle, the replacement of one dominant follicle by another occurs on average after 8.5 days with fluctuations from 6 to 14 days. During spontaneous regression of the corpus luteum, the dominant follicle of the last growth wave enters the final stage of development, matures and ovulates. The follicular wave begins with the release of a group (2-6 pcs.) of follicles with a diameter of (2-5 mm).

Based on the ultrasound examination results of the ovaries of experimental cows, the size and number of follicles, the beginning and end of the dominant follicle growth phase during the development wave, as well as the duration of the dominant follicle growth period were determined. It was found that 6-6.5% of cows have one wave of follicle growth, and on average 45% have two waves and 40% have three growth waves. On average, 6% have four waves of follicle growth. The shortest oestrus was noted in cows with 3 waves of follicle growth, while the highest fertility results were noted in cows with 2 waves of follicle growth.

The total number of primary, secondary and tertiary follicles in the histological section was 80.22 ± 2.5 of which 72.67% were primary, 15.83% were secondary and 11.48% were tertiary. A significant proportion of tertiary follicles (67.64%), mainly small and medium-sized with a diameter of 867.72±86.74 μm, were in a state of obliterative atresia, and 14.33% of large follicles with a diameter of 2345.62 ± 352.31 μm had cystic atresia.

Table 3. Biochemical values of blood of cows in basic farms

#	Indicators	Unit	Cows (n-28) X±m
Alimzhanov TS farm			
1.	Alkaline phosphatase	U/l	128±6.88
2.	Calcium	mmol/l	9.86±0.28
3.	Phosphorus	Mg%	5.5±0.24
4.	Potassium	Mg%	5.01±0.20
5.	Magnesium	mmol/l	1.1±0.10
6.	Protein	g/l	7.2±0.24
7.	ALT	mmol/l	26.75±1.18
8.	AST	mmol/l	70.02±4.45
9.	Urea	Mg%	6.45±0.59
10	Sodium	Mg%	305.2±6.58
Abdrakhmanov Bolat Dauletbekovich SP			
1.	Alanine aminotransferase	u/l	42.6±8.5
2.	Aspartate aminotransferase,	u/l	79.4±15.4
3.	Glucose	mmol/l	3.34±0.64
4.	Iron	μmol/l	20.59±4.37
5.	Calcium	mmol/l	2.04±0.17
6.	Urea	mmol/l	2.93±0.30
7.	Total protein	mg/dL	8.68±0.72
8.	Phosphorus	mmol/l	2.28±0.30
9.	Alkaline phosphatase	u/l	146.9±117.71

Table 4. Reproductive traits of local Tuvan cattle

Indicators	Population	
	Forest-steppe (n = 20)	Dry steppe (n = 20)
Age at first calving (days)	862.9 ± 7.5	895.6 ± 8.1
Duration of the fruiting period (days)	271.6±8.9	277.3±12.6
Duration of service period (days)	90.7±3.6	97.3±2.8
Duration of the dry period (days)	179.5±5.1 **	238.2±12.4
Duration of the intercalving period (days)	368.6±9.2 *	393.6±15.7
Reproductive Capacity Coefficient (KBC)	0.99	0.93

Secondary or antral follicles, cystic, vesicular follicles were characterized by an increase in the number of layers of follicular epithelium, called the granular layer or granulosa, the appearance of a cavity and the formation and differentiation of connective tissue membranes (theca interna and theca externa) with the growth of blood vessels in them. The diameter of the developing follicle reached 6 - 9 mm. The duration of the transformation of the primary follicle into a secondary one in cattle took about 130 days. In the last three weeks of pregnancy, the growth of follicles in the ovaries of cows stopped. Resumption of cyclic growth of antral follicles in cows occurred already on the 8th - 10th day after calving. Often the first ovulation occurred without visible manifestation of oestrus and a full cycle, and only the second cycle of the postpartum period was accompanied by dominant follicles, ovulation occurred between the 30th and 35th day of the postpartum period.

Results of studies of reproductive traits of cows of local Tuvan cattle showed that the age of first calving is 862.9±7.5 days for the forest-steppe population and 895.6 ± 8.1 days for the dry-steppe population (Table 4).

The duration of fruiting in cows of local Tuvan cattle was the same and amounted to 271.6 - 277.3 days. The service period is a variable trait in cattle breeding. In more than half of the analyzed cows (69.2%), the duration of the service period exceeded 91 days (Titova, 2021). Based on the results of the studies, it was established that the duration of the service period is 90.7 days for local Tuvan cattle of the forest-steppe population and 97.3 days for the dry-steppe population.

It is known that with a short service period, the yield of calves per 100 cows increases sharply (Zubkova, Zhernosenko, 2020). The reproductive capacity coefficient (KBC) of local Tuvan cattle was 0.99 in the forest-steppe population and 0.93 in the dry-steppe population.

The duration of the intercalving period for cows of local Tuvan cattle of the forest-steppe population is 368.6 days, which is significantly lower in comparison with peers of the dry-steppe population - 393.6 days.

The duration of the dry period was 179.5 days for cows in the forest-steppe population and 238.2 days for cows in the dry-steppe population.

The duration of the dry period was 179.5 days for cows in the forest-steppe population and 238.2 days for cows in the dry-steppe population. Adult cows of local Tuvan cattle of the forest-steppe population have an average height at the withers of 128.2 cm, an oblique body length of 149.3 cm, a chest girth of 171.2 cm and a metacarpus girth of 21. cm, a height at the rump of 135.1 cm. Mates of the dry-steppe population have body measurements of 126.7-146.6-168.5-20.7-133.6 cm. The examined cows of local Tuvan cattle, according to body measurements, corresponded to the elite class + class I (Table 5).

The highest commercial milk yield over 180 days of lactation is characterized by cows of local Tuvan cattle of the forest-steppe population (1657.8 kg), in comparison with their mates of the dry-steppe population (1323.0 kg).

The milking capacity coefficient for the cows of the studied gene pool of the forest-steppe population was 650 kg and for the dry-steppe population 560 kg. (Table 6).

Table 5. Measurements and live weight of adult dairy cows of local Tuvan cattle

Indicators	Measurements, cm				
	Height at Withers	Oblique Body Length	Girth		Height at the Rump
			Chest	Metacarpus	
Forest-steppe population (n = 20)					
X± mx	128.2±0.6	149.3±0.5	171.2±1.6	21.2±0.09	135, 1 ± 0.8
Lim	122 - 130	145 - 154	168 - 175	21.0 – 22.0	130 - 140
σ	0.5	1.1	1.4	0.09	1.1
C V	2.9	1.4	3.1	0.6	1.8
Dry-steppe population (n = 20)					
X ± m x	126.7±0.3	146.6±0.3	168.5 ± 2.1	20.7±0.06	133.6 ± 0.5
Lim	117 - 128	143 - 150	162 - 172	20.5 – 21.0	130-135
σ	0.4	0.8	1.8	0.07	0.9
C V	2.5	1.9	2.7	0.9	1.5

Table 6. Milking performance of adult dairy cows of local Tuvan cattle

Population (n = 20)	Live weight (kg)	Actual milk yield (kg/day)	Actual milk yield (kg/180 days)	Gross milk yield† (kg/day)	Gross milk yield† (kg/180 days)	Milk flow rate (kg/min)	Milking capacity coefficient‡
Forest-steppe	416.6 ± 9.7	9.21 ± 0.27	1657.8 ± 59.3**	14.84 ± 0.79	2671.2 ± 168.1**	1.72 ± 0.06	650**
Dry-steppe	385.8 ± 7.5	7.35 ± 0.19	1323.0 ± 31.4	11.92 ± 0.68	2145.6 ± 143.9	1.63 ± 0.03	560

Notes:
† Gross milk yield includes milk consumed by the calf.
‡ Milking capacity coefficient is calculated per 100 kg of live weight.
** Statistically significant difference between populations ($p < 0.01$).

Table 7. Biochemical composition of milk from full-aged cows of local Tuvan cattle

Forest-steppe population (n = 20)

Parameter	Fat (%)	Protein (%)	Lactose (%)	Ash (%)	Density (°A)	Acidity (°T)
Mean ± SE (X ± m_x)	4.40 ± 0.05**	3.50 ± 0.03	4.60 ± 0.12	0.93 ± 0.07	29.3 ± 0.09	15.9 ± 1.34
SD (δ)	0.16	0.08	0.08	0.05	0.99	1.17
CV (%)	7.2	3.7	1.9	9.3	1.8	11.9
Range (Lim)	3.8–4.8	3.0–4.0	4.2–4.8	0.88–0.99	29.0–30.0	15–18

Dry-steppe population (n = 20)

Parameter	Fat (%)	Protein (%)	Lactose (%)	Ash (%)	Density (°A)	Acidity (°T)
Mean ± SE (X ± m_x)	3.40 ± 0.04	3.10 ± 0.02	4.80 ± 0.09	0.97 ± 0.09	28.1 ± 0.11	16.2 ± 1.36
SD (δ)	0.09	0.06	0.09	0.06	1.01	1.08
CV (%)	4.9	2.4	2.1	10.1	1.4	8.7
Range (Lim)	3.1–4.1	2.8–3.5	4.2–5.0	0.90–0.99	27.8–28.5	15–18

Notes:
X ± m_x = arithmetic mean ± standard error; SD = standard deviation; CV = coefficient of variation.
** Statistically significant difference compared with the dry-steppe population ($p < 0.01$).

Table 8. Correlation coefficients (r) between dairy productivity traits of local Tuvan cattle

Trait pair	Forest-steppe population (n = 20)	Dry-steppe population (n = 20)
Milk yield (kg) – Milk fat (%)	−0.25	−0.36
Milk yield (kg) – Milk protein (%)	−0.12	−0.22
Milk fat (%) – Milk protein (%)	+0.16	+0.18
Milk yield (kg) – Milk fat yield (kg)	+0.78	+0.88
Milk yield (kg) – Milk protein yield (kg)	+0.85	+0.92
Milk fat yield (kg) – Milk protein yield (kg)	+0.92	+0.94

The lowest milk flow rate is observed in cows of the dry-steppe population - 1.63 kg/min, the highest in the forest-steppe population - 1.72 kg/min.

The results of studies of biochemical parameters of milk of adult cows of local Tuvan cattle made it possible to determine in the forest-steppe population the fat content of 4.4%, protein 3.5%, lactose 4.6%, ash 0.93%, with a milk density of 29.3 ° A and acidity 15.9 ° T. In cows of local Tuvan dry-steppe cattle, the fat content in milk was 3.4%, milk protein 3.1%, lactose 4.8%, ash 0.97%, milk density 28.1 ° A and acidity 16.2 ° T (Table 7).

With an increase in milk yield, a decrease in the mass fraction of milk fat and protein in milk is observed. The influence of population on the correlation coefficient between milk yield and the mass fraction of fat, which varies from -0.25 to -0.36, has not been established. The correlation coefficient between milk yield and the mass fraction of protein milk varies from -0.12 to -0.22. A very high positive relationship was established between milk yield and the amount of milk fat (from +0.78 to +0.88) and protein (from +0.85 to +0.92) (Table 8).

The correlation coefficient between the amount of milk fat and milk protein is +0.92 and +0.94 in Tuvan local cattle.

Conclusion

The physiological state of cows and the initial reproduction indices of the experimental farms of the Alimzhanov T.S. farm and the Abdrakhmanov Bolat Dauletbekovich SP were studied, where the service period was 185 days and 125 days, respectively, the insemination index was 3 doses and 2.5 doses per fruitful insemination, the effectiveness of the first insemination was 33% and 40%, respectively, and the age at the time of the first calving was 28 months and 25 months.

The gynecological condition of experimental cows of farms in the amount of 375 animals of the Holstein breed in the farm "Alimzhanov T.S." was monitored, where the amount of ovarian dysfunction in the form of hypofunction and follicular cysts was 6.9% and 6.7%, respectively, inflammation of the mucous membrane in the form of adhesion of the horns and atony of the uterus were detected on average in 5.6% of the studied livestock, the main causes of which are the consequence of difficult calving and retention of the placenta, as well as 312 animals of the Simmental breed in the Abdrakhmanov Bolat Dauletbekovich farm, where the amount of ovarian dysfunction in the form of hypofunction was 3.5% and follicular cysts 2.9%, inflammation of the mucous membrane in the form of adhesion of the horns and atony of the uterus were detected on average in 2.9% of the studied livestock.

The biochemical parameters of the blood of dairy cows from experimental farms were studied, where it was established that all parameters were within the physiological norm, and according to the results of ultrasound examination of the ovaries of experimental cows, the size and number of follicles, the beginning and end of the growth phase of the dominant follicle during the development wave, as well as the duration of the growth period of the dominant follicle were established.

Results of the studies of reproductive traits of cows of local Tuvan cattle showed that the age of first calving is 862.9±7.5 days for the forest-steppe population and 895.6±8.1 days for the dry-steppe population. The duration of fruit-bearing in cows of local Tuvan cattle was the same and amounted to 271.6 - 277.3 days. Based on the results, it was established that the duration of the service period is 90.7 days for local Tuvan cattle of the forest-steppe population and 97.3 days for the dry-steppe population. The reproductive capacity coefficient of local Tuvan cattle was 0.99 in the forest-steppe population and 0.93 in the dry-steppe population. The duration of the intercalving period for cows of local Tuvan cattle of the forest-steppe population is 368.6 days, which is significantly lower in comparison with mates of the dry-steppe population - 393.6 days. The duration of the dry period was 179.5 days for cows in

the forest-steppe population and 238.2 days for cows in the dry-steppe population. The examined full-aged cows of local Tuvan cattle, according to body measurements, corresponded to the elite class + class I. The highest commercial milk yield over 180 days of lactation is characterized by cows of local Tuvan cattle of the forest-steppe population (1657.8 kg), in comparison with their mates of the dry-steppe population (1323.0 kg). The milk production coefficient for the cows of the studied gene pool of the forest-steppe population was 650 kg and for the dry-steppe population 560 kg. The results of studies of milk biochemical parameters of full-aged cows of local Tuvan cattle made it possible to determine in the forest-steppe population the fat content of 4.4%, protein 3.5%, lactose 4.6%, ash 0.93%, with a milk density of 29.3 ° A and acidity 15.9 ° T. In adult cows of local Tuvan dry-steppe cattle, the fat content in milk was 3.4%, milk protein 3.1%, lactose 4.8%, ash 0.97%, milk density 28.1 ° A and acidity 16.2 ° T.

With an increase in milk yield, a decrease in the mass fraction of milk fat and milk protein is observed. The influence of population on the correlation coefficient between milk yield and the mass fraction of milk fat, which varies from -0.25 to -0.36, has not been established. The correlation coefficient between milk yield and the mass fraction of protein in milk varies from -0.12 to -0.22. A very high positive relationship was established between milk yield and the amount of milk fat (from +0.78 to +0.88) and protein (from +0.85 to +0.92). The correlation coefficient between the amount of milk fat and milk protein is +0.92 and +0.94 in Tuvan local cattle.

Adult cows of local Tuvan cattle are characterized by a strong constitutional type and good milk production (Baimukanov *et al.*, 2024b).

The resulting cow's milk corresponds in biochemical composition to a highly nutritious dairy product.

A selection group of local Tuvan cattle on breeding farms must have a milking capacity coefficient for the forest-steppe population of 650 kg and the dry-steppe population of 560 kg.

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Author Contributions

Anuarbek Temirbekovich Bissembayev: Head of research, development of research methodology, analysis of research results, contribution 20%.

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Nataliya Ivanovna Kulmakova, Olga Viktorovna Bondarenko, Ailana Mongun-oolovna Kombu: Performer of experimental research, contribution 30%.

Dastanbek Asylbekovich Baimukanov: The author of the idea, the rationale for choosing the direction of research, writing a manuscript, the author of correspondence, contribution 20%.

Ethics

The authors of the article confirm the absence of a conflict of interest with third-party organizations.

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