

Reproductive Indicators of the Alatau Cattle Breed of Kazakhstan Population

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Abstract: The research aims to study the reproductive indicators and dairy productivity of the modern Kazakhstan population of the Alatau cattle breed. The average duration of the dry period is within the physiological norm, being 60-75 days. As noted above, an increase in the service period can negatively affect herd reproduction. In this regard, some measures were taken to normalize the service period of 83.5, 79.6-83.5 days. The efficiency of the insemination of cows is 92-95%. In comparison with 2018, in 2019, milk productivity increased on average by 3.64% or 197.5 kg of milk, in 2020 by 5% or 268.8 kg of milk, in 2021-by 13.6% or by 736.7 kg of milk, but in 2022 there was a sharp decrease of 28% or 972.6 kg of milk Alatau cows during the first lactation produce milk in the amount of 5262.3 ± 39.7 kg, with a fat content of 3.90% and a milk protein content of 3.25%. In the second lactation, the milk yield increases to 5788.9 ± 51.0 kg, and in the third lactation to 5786.7 ± 33.8 kg.

Keywords: Dairy Cattle Breeding, Brown Cattle, Alatau Breed, Milk Yield, Service Period, Line

Introduction

Cattle of Alatau were bred by complex reproductive crossing of domestic Kazakh and Kyrgyz cattle with Shvitskaya and Kostroma breeds. The resulting hybrids were larger and more enduring than the parents and had a higher milk yield per lactation. It was officially approved in 1950 (Muradyan *et al.*, 2022).

Cows are highly fertile and can bring 10-12 calves during their productive life. Animals of this breed adapt well to hot and cold climates. They are highly resistant to infectious diseases and differ in milk productivity and good meat qualities (Lebedko and Pilipenko, 2019).

As of June 01, 2023, according to the information and analytical system of the Republican livestock breeding

system (www.plem.kz), the number of breeding stock of Alatau cattle is 6893 animals, bred in more than 100 small and large farms.

The average productivity of cows is 5700 kg of milk with a fat content of 3.9% (Koltsov *et al.*, 2020).

The Alatau breed is capable of showing high milk productivity with good maintenance technology (Baimukanov *et al.*, 2021).

With an increase in milk yield, the fat content of milk remains stable (Alentayev *et al.*, 2018).

The production efficiency of livestock products is closely related to the reproduction of animals (Santos *et al.*, 2017; Baimukanov *et al.*, 2019a; McDougall, 2006; Safa *et al.*, 2013).

When selecting, all the main selection parameters affecting milk productivity are taken into account (Kadokawa *et al.*, 2012; Wondossen *et al.*, 2018; Cardoso Consentini *et al.*, 2021).

The reproductive ability of livestock depends on many factors: Age and live weight during fruitful insemination of heifers, feeding, production technology, physiological state of the animal, etc. For stable livestock production, maintaining the optimal structure of the herd (Clasen *et al.*, 2020).

Zootechnic characteristics are the number of offspring received from one female for a certain period (Calsamiglia *et al.*, 2020).

It is noted that if a cow has long and continuous periods of lactation, then this can cut up the health and life of the animal. The service period is the normal physiological cycle of the cow, in which the cow prepares for fruitful insemination. The optimal service period is 80-90 days (Walsh *et al.*, 2011).

The biggest use in the populations of the Alatau breed in Kazakhstan, as well as in the world dairy cattle breeding, was received by the brown Swiss breed of the USA, which gave a powerful impetus for their further development (Alentayev *et al.*, 2018).

The efficiency of the accelerated herd turnover is ensured if each generation of the servicing bulls is better in terms of breeding value than the previous one. Well-known problems with herd reproduction should be solved by timely treatment of animals after calving, organization of active exercise, timely identification of cows and heifers in heat, and improvement of artificial insemination techniques (Fleming *et al.*, 2018; Baimukanov *et al.*, 2022).

To study the reproductive indicators and dairy productivity of the modern Kazakhstan population of the Alatau cattle breed. Determination of reproductive indicators of the studied Alatau breed animals for 2019-2020. Productive indicators of Alatau cows for 5 years in the period 2018-2022 in the context of calving.

Materials and Methods

The material for the study was cattle of the combined direction of productivity of domestic breeding of the Alatau breed, bred in modern Kazakhstan.

The research work was performed in 2018-2022 years. During the research, the basic principles of breeding in dairy cattle breeding were observed (Abugaliyev *et al.*, 2019).

The evaluation of the service period was carried out according to the generally accepted methodology (Alentayev *et al.*, 2022).

The duration of the service period was studied in compliance with the basic methodological approaches

adopted in dairy cattle breeding (Abugaliyev *et al.*, 2019; Gorelik *et al.*, 2021a).

Milk yield was studied during 305 days of lactation, with the determination of fat and protein in milk (Abugaliyev *et al.*, 2019; Alekseeva and Chetvertakov, 2021; Bolotova and Chalova, 2020; Grinchuk and Nesterov, 2021; Gorelik *et al.*, 2021b).

Milk yield was studied by lactation (Gorelik *et al.*, 2022c).

The calculation of the milk volume, milk fat, and milk protein per lactation was carried out in accordance with the methods recommended by the International Committee for Animal Records (ICAR).

Milk analysis was carried out in accredited laboratories using Combi Foss FT+ milk analyzers that meet ICAR criteria.

The received digital data are processed by the method of statistical processing (Baimukanov *et al.*, 2022).

Results and Discussion

In numerous scientific works, it is noted that the formation of dairy productivity is greatly influenced not by the age of heifers, but by their live weight (Baimukanov *et al.*, 2019b; Abugaliyev *et al.*, 2021).

The average duration of the dry period is within the physiological norm, being 60-75 days. As noted above, an increase in the service period can negatively affect herd reproduction. In this regard, some measures were taken to normalize the service period from 83.5 days (2019) to 79.6 days (2020). The efficiency of the insemination of cows is 92-95% (Table 1).

In 2018, 2713 cows, daughters of 47 bulls belonging to 9 lines were monitored (Table 2). The milk yield of the daughters was 5532±165 kg.

Exchange lines: Concentrate are inferior to the average yield of 163 kg or 2.3%; Kylian 181455 will exceed 484 kg or 8.7%; Course Line 197970 is inferior to 721 kg or 13.0%; Meridian is inferior to 289 kg or 4.5%; Oregon 86356 will exceed 18 kg or 0.3%; Master 106902 exceeded 497 kg or 9.0%; Teddy 76bs9013 exceeded 270 kg or 4.9%; West lawn exceeded 225 kg or 4.0%; hilites-Adema are inferior to 511 kg or 9.2%.

In comparison with 2018, in 2019, milk productivity increased on average by 3.64% or 197.5 kg of milk, in 2020 by 5% or 268.8 kg of milk, in 2021-by 13.6% or by 736.7 kg of milk, but in 2022 there was sharp decrease of 28% or 972.6 kg of milk. In 2018, the milk yield of cows of the Alatau breed was 5422.5 kg, in 2019-5620.0 kg, in 2020-5691.3 kg, in 2021-6159.2 kg, and in 2022-4449.9 kg.

The fat content in milk in 2018 was 3.86%, 2019 3.88%, 2020 3.91%, 2021 3.98%, 2022 3.91%. The protein content in milk was 3.24% in 2018, 3.27% in 2019, 3.31% in 2020, 3.31% in 2021 and 3.32% in 2022 (Table 3 and Figs. 1-2).

Table 1: Reproductive indicators of the studied animals of the Alatau cattle breed in 2019-2020

Live weight, kg				Breeding sale, animals		
	Heifersat insemination	Calf yield per 100 cows, %	Service period duration, days	Total	Including Heifers	Bull-calves
2019	380	92	83.5±3.4	244	223	
2020	350	95	79.6±4.6	440	350	90

Table 2: Productive traits of animals in the context of lines (2018)

Lines	Number of bull-fathers	Number of the irdaughters	Per 1 producer	Milk yield of mothers of the fathers	Milk yield of mothers of the daughters
1 Concentrate	8	553	69.1	11109	5369±124
2 Kylan 181455	2	56	28.0	10245	6016±890
3 CourseLine 197970	2	150	75.0	11261	4811±158
4 Meridian	8	361	45.1	10868	5283±142
5 Oregon 86356	1	46	46.0	11192	5550±177
6 Master 106902	9	373	41.4	11318	6029±820
7 Teddy 76BS9013	4	452	113.0	10147	5802±201
8 West Lawn	11	646	58.7	11497	5757±141
9 Hilties-Adema	2	76	38.0	11217	5021±122
Total for the breed	47	2713	57.7	10984	5532±165

Table 3: Productive indicators of cows of the Alatau breed for 5 years in 2018-2022

Period	n	Milk yield, kg		Fat, %		Protein, %	
		X ± m	Cv	X ± m	Cv	X ± m	Cv
2018	736	5422.5±45.40	22.7	3.86±0.01	3.8	3.24±0.00	3.3
2019	821	5620.0±44.10	22.5	3.88±0.01	4.0	3.27±0.00	4.2
2020	629	5691.3±41.80	18.4	3.91±0.01	4.6	3.26±0.00	3.5
2021	467	6159.2±53.20	18.7	3.98±0.01	4.3	3.31±0.01	3.6
2022	55	4449.9±238.6	39.8	3.91±0.05	3.7	3.32±0.02	3.9

In our opinion, these dynamics of a sharp decrease in milk farms engaged in breeding Alatau cattle keep livestock in camp and pasture conditions. Also in 2022, dry weather conditions were observed, which led to the burning of pastures and a fodder shortage, respectively, a decrease in milk productivity and reproductive traits of animals with a minimum yield of offspring. In terms of milk fat content and milk protein content, slight changes were observed, which varied between 0.12% for fat and 0.08% for protein.

The first lactation produces milk in the amount of 5262.3±39.7 kg, with a fat content of 3.90% and a milk protein content of 3.25%. In the second lactation, the milk yield increases to 5788.9±51.0 kg, and in the third lactation to 5786.7±33.8 kg (Table 4, Fig. 3).

The maximum milk yield is observed in the first two months of lactation, from the fourth month it gradually decreases (Table 5).

Starting from the second month of lactation, the cows show a significant decrease in milk yield (Fig. 4).

Cows of the first lactation in the first two months have a milk yield of 19.2 kg, with a further decrease of 0.6 kg or 3.1%. Milk yield in the fourth month of lactation is 17.9 kg, the fifth 17.3 kg, the sixth 16.8 kg, the seventh 16.6 kg, the eighth 16.2 kg, the ninth 15.8 kg and the tenth 15.3 kg. The fat index in milk is 3.85-3.90% and protein 3.20-3.28%.

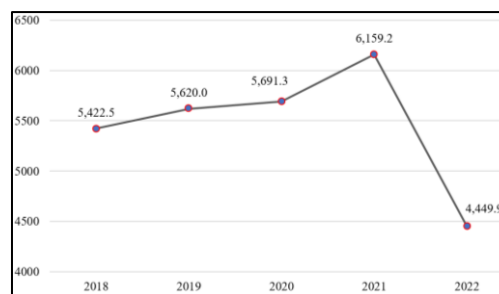


Fig. 1: Dynamics of the variability of milk yield (kg) of the Alatau cows for 305 days of lactation in 2018-2022

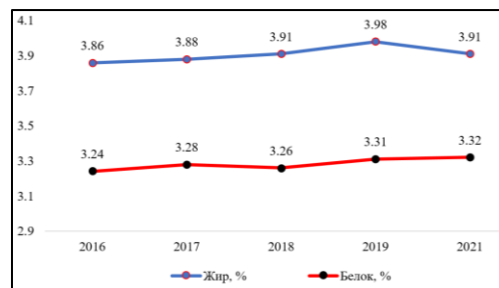


Fig. 2: Dynamics of the variability of fat and protein content in milk (%) of the Alatau cows for 305 days of lactation

Table 4: Productive indicators of Alatau cows for 5 years in the period 2018-2022 in the context of calving

Lactation	n	Milk yield, kg		Fat, %		Protein, %	
		X ± m	Cv	X ± m	Cv	X ± m	Cv
1 st	698	5262.3±39.7	19.9	3.90±0.01	4.2	3.25±0.0	3.6
2 nd	703	5788.9±521.0	23.3	3.89±0.01	4.1	3.27±0.0	3.6
3 rd and further	1307	5786.7±33.8	21.1	3.89±0.00	4.5	3.27±0.0	4.0

Table 5: Dynamics in variability of monthly control milk yields of the Alatau cows for 5 years in 2018-2022 in the context of calving

Month of lactation	1 st lactation						2 nd lactation						3 rd and further lactation					
	n = 698		n = 703		n = 1307		n = 703		n = 703		n = 703		n = 703		n = 703		n = 703	
	Milk yield, kg	Fat, %	Protein, %	Milk yield, kg	Fat, %	Protein, %	Milk yield, kg	Fat, %	Protein, %	Milk yield, kg	Fat, %	Protein, %	Milk yield, kg	Fat, %	Protein, %	Milk yield, kg	Fat, %	Protein, %
	X ± m	Cv	X ± m	Cv	X ± m	Cv	X ± m	Cv	X ± m	Cv	X ± m	Cv	X ± m	Cv	X ± m	Cv	X ± m	Cv
1	19.2±0.17	23.0	3.86±0.02	10.5	3.2±0.001	12.1	20.9±0.2	25.4	3.91±0.02	10.6	3.26±0.01	10.4	22.0±0.15	24.2	3.89±0.01	10.7	3.26±0.01	9.5
2	19.2±0.16	22.2	3.87±0.02	12.0	3.23±0.01	10.7	21.6±0.21	26.0	3.88±0.02	10.9	3.23±0.01	9.9	22.3±0.15	23.5	3.85±0.01	11.0	3.25±0.01	10.3
3	18.6±0.17	23.8	3.91±0.02	11.7	3.23±0.01	11.1	20.9±0.22	27.4	3.86±0.02	11.0	3.23±0.01	10.0	21.3±0.14	24.5	3.87±0.01	10.7	3.26±0.01	9.8
4	17.9±0.16	24.3	3.88±0.02	11.4	3.24±0.01	10.5	20.2±0.21	27.8	3.85±0.02	12.3	3.24±0.01	10.0	20.1±0.14	24.6	3.84±0.01	10.1	3.25±0.01	9.7
5	17.3±0.16	24.9	3.85±0.02	12.8	3.24±0.01	10.6	19.4±0.21	28.3	3.85±0.02	12.2	3.25±0.01	10.9	19.4±0.14	25.9	3.86±0.01	11.6	3.26±0.01	10.4
6	16.8±0.17	26.2	3.88±0.02	11.9	3.25±0.01	10.9	18.7±0.20	28.8	3.87±0.02	12.0	3.27±0.01	9.7	18.5±0.14	27.1	3.87±0.01	10.6	3.26±0.01	10.2
7	16.6±0.16	24.8	3.88±0.02	12.1	3.26±0.01	10.3	18.1±0.20	29.9	3.87±0.02	10.9	3.28±0.01	9.4	17.9±0.14	28.2	3.86±0.01	10.7	3.28±0.01	9.8
8	16.2±0.15	24.8	3.9±0.002	11.6	3.27±0.01	10.1	17.4±0.19	29.6	3.83±0.02	11.0	3.28±0.01	9.9	17.2±0.14	28.8	3.86±0.01	11.0	3.27±0.01	9.5
9	15.8±0.16	26.0	3.86±0.02	11.8	3.26±0.01	10.0	16.7±0.19	29.7	3.86±0.02	10.9	3.29±0.01	10.9	16.5±0.14	31.2	3.89±0.01	11.7	3.28±0.01	9.8
10	15.3±0.16	27.3	3.87±0.02	11.2	3.28±0.01	10.3	15.7±0.19	32.0	3.86±0.02	11.3	3.29±0.01	9.8	15.4±0.14	33.6	3.88±0.01	11.8	3.27±0.01	10.0

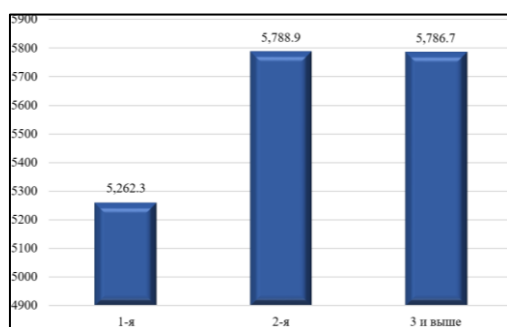


Fig. 3: Variability of milk productivity of the Alatau cows for 305 days of lactation in the context of calving of the 1st, 2nd, 3rd, and further lactations

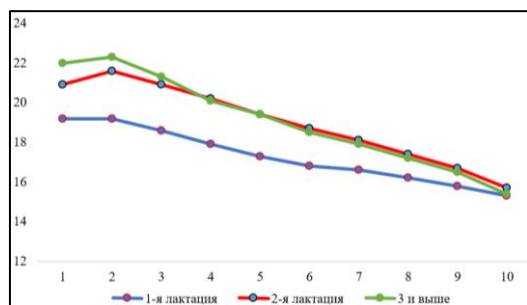


Fig. 4: Dynamics of the variability of monthly control milk yields of the Alatau cows for 305 days of lactation in the context of calving of the 1st, 2nd, 3rd, and further lactations



Fig. 5: Cow of Alatau breed, elite class

In the second lactation, cows have a daily milk yield of 20.9 kg in the first month, 21.6 kg in the second, and 20.9 kg in the third, with a further decrease in the fourth month by 0.7 kg or 3.3%. From the fifth month, milk yield decreases from 19.4-15.7 kg by the tenth month of lactation. The fat content in milk is 3.83-3.91% and protein is 3.23-3.29%.

In the third month of lactation, milk yield in the first three months of lactation is 22.0-22.3-21.3 kg, the next three months 20.1-19.4-18.5 kg, in the last four months 17.9-17.2-16.5-15.4 kg. The fat content in milk is 3.84-3.89% and protein are 3.25-3.28%.

This pattern is observed in cows of the first, second, and third lactation.

The data obtained are new and characterize the dynamics of the variability of monthly control milk yields of cows of the Alatau breed.

Cows of the Alatau breed are distinguished by good udder development (Fig. 5).

The Alatau breed of the Kazakh population has a milk productivity from 4449.9 to 6159.2 ± 53.2 kg. The content of milk fat is 3.86-3.91%, and milk protein is 3.24-3.32%. It was found that cows of the Alatau breed have high milk yield in the first three months of lactation, in fact, from the fourth month of lactation to the end of the tenth month of lactation, milk yield decreases by 20% in the first lactation, 25% in the

second and 30% in the third. This pattern is a breed feature of the Alatau cattle breed of the Kazakh population.

The results of the conducted studies have shown that cattle of the Alatau breed of the Kazakh population have a high variability in milk yield (4449.9- 6159.2 kg) over the past 5 years (2018-2022). In the context of farms, milk yield is 4463-6741 kg (Baimukanov *et al.*, 2021). This is due, firstly, to various technologies of breeding work on farms, and secondly, to the use of the seed of breeding bulls.

Conclusion

The Alatau breed is a unique domestic breed of cattle, it is necessary to carry out a targeted assessment and selection of cows by milk productivity, in order to increase the selection differential and the effect of selection.

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Author's Contributions

Aidar Dastanbekuly Baimukanov: Responsible executor, experimental part of the research. corresponding author, preparation of the manuscript. Share of implementation and contribution to the preparation of the article.

Anuarbek Temirbekovich Bissembayev, Alzhan Smailuly Shamshidin, Kharon Adievich Amerkhanov and Azamat Kuandikovich Saginbayev: Share of implementation and contribution to the preparation of the article.

Yusupzhan Artykovich Yuldashbayev: Performer, analysis of experimental data. Share of implementation and contribution to the preparation of the article.

Askhat Erbosynovich Chindaliyev: Executor, performer, analysis of research results. Share of implementation and contribution to the preparation of the article.

Khamit Ablgazinovich Aubakirov: Author of the idea, analysis and generalization of the obtained data, Share of implementation and contribution to the preparation of the article.

Ethics

During the research, ethics were observed in the process of studying the milk productivity of experimental animals of the studied breed. The authors of the article confirm the absence of a conflict of interest with third-party organizations.

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