Technology to improve milk productivity of female camels of the Arvana breed and Kazakh bactrian

D A Baimukanov1*, V G Semenov2, N N Alibaev3, A B Baimukanov3, T N Karymsakov4, M N Ermakhano3 and K ZH Iskhan1

1Department of Physiology, Morphology, and Biochemistry named after Academician Neyli Urazaeva Bazanova, Kazakh National Agrarian University, 8 Abay Avenue, Almaty, 050010, Republic of Kazakhstan
2Faculty of Veterinary Medicine and Animal Science, Chuvash State Agricultural Academy, 29 K. Marx Street, Cheboksary, 428003, Russia
3Department of camel husbandry, South-West Scientific Research Institute of Animal Husbandry and Plant Growing, 3 area Al-Farabi, Al-Farabi district, Shymkent, 160002, Republic of Kazakhstan
4Scientific department, Kazakh Research Institute of Livestock and Forage Production, Zhandosova street, Almaty, 050010, Republic of Kazakhstan

*E-mail: dbaimukanov@mail.ru

Abstract. It is proved that milk yield in winter is characterized by a decrease in the absolute indicator of the average daily milk yield with a simultaneous increase in the mass fraction of fat in milk in camels, regardless of the breed and the zone of their breeding. On average, the milk yield in December - February for camels of Arvan breed was from 4.8 kg to 6.4 kg, with a mass fraction of fat in milk of 4.6 - 4.7%. In winter, the milk yield of the Kazakh Bactrian camels in comparison with the peers of the Arvan breed of the "bestorrangyla" plant type is 2.5 times lower. The female camels of the Kazakh Bactrian in the first and second months of the winter period did not experience a sharp decrease in milk yield and on average December 2.5 - 3.0 kg and January 2.3 - 2.8 kg. At the end of the winter period - in February it drops sharply and reaches the level of 1.6-2.1 kg. At the same time, the fat content of milk in the winter period is in the redistribution of 5.9 – 6.2%.

1. Introduction
Camels are one of the few animals that not only survive in extreme climatic conditions, but also classified as mammals that can produce raw products for human needs. Being a unique domestic animal, camel has not lost its significance for the world community nowadays. This is proved out by the growth of camel’s abundance in the world. Currently, camel's milk production is observed in many countries of the world, mainly in Asia and Africa due to increased demand and national preferences. Kazakhstan is one of the vast regions of Eurasia, where there are enough suitable lands for camel husbandry. Agriculturally used areas in Kazakhstan are about 80 million hectares, most of which are allocated to permanent pastures and occupies about 61 % [1]. In addition, Kazakhstan has a flat land of about 190 million hectares, which can be considered as potential areas for camel husbandry [2].
Kazakhstan has a unique climate that is best suited for camel breeding. Camel breeding in the Republic of Kazakhstan has ample opportunities to develop the industry and integrate this type of food both inside the country and outside of it. According to available data, in 2017 the volume of agricultural products in Kazakhstan is estimated at about 7 million tons per year, the average annual growth in food production is 7 %. Due to its high nutritional value and therapeutic properties, camel's milk can be evaluated as an alternative source of preventive nutrition for the world population [3].

In modern conditions, one of the priorities of traditional animal husbandry - camel breeding requires a transition from extensive to intensive management of the industry with the development of production technology for industry-specific products [4].

In the arid desert and semi-desert zones of Kazakhstan, where it is difficult to breed other types of dairy animals, camel breeding is a traditional and promising area of dairy farming [5].

Dairy camel breeding in the arid zone of the south-western region has the opportunity until 2020 to occupy a niche of premium class. Brand products - camel milk and shubat are distinguished by valuable nutritional qualities, dietary, healing properties and environmental friendliness and are in high demand in the domestic and foreign markets.

In this regard, the development of intensive technologies for the production of camel products is a relevant area of research of the agro-industrial complex of the Republic of Kazakhstan.

The main task in the production of camel products is the development of efficient technologies for leading the industry in priority areas of high-yield areas of specialization.

The main task of the domestic agro-industrial complex is to ensure sustainable growth of the population of highly productive camel breeds and the production of high-quality livestock products, which will solve the actual problem of providing camel farms with the necessary genetic material and food saturation of the food market and raw materials industry [6].

In the Republic of Kazakhstan, camels are mainly represented by the genotypes of the meat-wool and meat-and-dairy direction of productivity [7]. For the production of camel milk, mainly dromedary camels are used, which are represented by the Turkmen breed imported in the Republic of Kazakhstan at the time [8].

Industry camel products - camel milk and its products are in demand both in the domestic market and in the Union and the Asia-Pacific Region). Six factory lines of the Kazakh Bactrian and 2 factory lines of the Kazakh dromedary are created in productive camel breeding.

For the first time in Kazakhstan, the genotyping of South Kazakhstan populations' dairy camels was carried out using DNA technology, which provides a reliable assessment of the genetic profile of highly productive individuals by microsatellite loci for development of dairy industry in different regions of the camel breeding location [9].

The results of genotyping of Bactrian and Dromedary Kazakh camel breeds by alpha-S1-casein, kappa-casein loci, and DNA fingerprinting indicate that the Dromedary breed female camels are more polymorphic as compared with Bactrian [10].

The domestic dairy camel industry needs an accelerated increase in high-milk genotypes and the development of intensive technologies to increase the productivity of domestic breeds in various zones of the south-western region of Kazakhstan.

In this regard, the current area of research is the development of intensive resource-saving technologies for the production of products (milk and wool) of pasture-distant camel breeding in various areas of the south-western region of Kazakhstan, ensuring an increase in the profitability of production by 30-45%.

The studies were conducted under two programs of targeted financing for 2018 – 2020. Ministry of agriculture of the Republic of Kazakhstan:

1. "Development of intensive technology for livestock industries", project: "The production of camel products"
2. "Development of a comprehensive system to increase productivity and improve breeding qualities of farm animals, on the example of LLP "Bayserke-agro" (section camel).

The purpose of the work is the development of technology for improving milk productivity of
camels of the arvana breed and Bactrian camel at different zones of productive camel (Arys-Turkestan, Aral, Caspian, Mangistau, Balkhash and Tau-Moyinkum area) and the production of fine wool (fluff) of different age and sex groups of camels; to assess the fecundity of the Kazakh Bactrian camels, depending on the class and direction of productivity under the conditions of the agricultural holding LLP “Bayserke-Agro”.

2. Materials and methods

The object of research was the populations of camels in different areas of productive camel breeding, bred at the “Byserke-Agro” holding of the Almaty region, Arys-Turkestan (“Usenov N.”, “Syzdykbekov A” and the “Gulmayra” agricultural complexes), Priaral ( LLP "Kulandinsky" and k/s "Korgan-NB"), Caspian (k/s "Dastan Ata" and LLP "Zhana-tan"), Mangistau (LLP "Karagantubek"), Pribalkhashskaya ( LLP "Kazbek-Bek") and Karatau-Moyinkum (k/s "Bagdat" and SEC "Karakur") zones of the Republic of Kazakhstan.

Milk productivity of the dairy herd was studied with the control milk yield.

Milk productivity of camels during the winter period was studied in different zones of southwestern Kazakhstan, in particular in Arys-Turkestan (“Usenova N.”, “Syzdykbekov A” and “Gulmayra”), Priaralskaya (“Kulandinsky” and k/s “Korgan-NB”), Pre-Caspian (k/s “Dastan Ata” and LLP “Zhana-tan”), Mangistau ( LLP “Karagantubek”), Pribalkhashskaya ( LLP “Kazbek-Bek”) and Karatau-Moyinkum (k/s "Bagdat" and SEC "Karakur").

Morphological and functional features of the udder of camels were determined according to the method of A. Baimukanov [11].

In order to assess the fertility of the camels of the Kazakh baktrian depending on the class and direction of productivity under the conditions of LLP "Baiserke - Agro" Almaty skoyoblasts, camels from 6 years and older were involved in the research object. Such indicators were studied as: the effectiveness of the incident for the 1st, 2nd and 3rd times; Fertilization in the 1st, 2nd and 3rd events. Analysis of duration of fruiting in camel women occurred in 2018 was carried out. Additionally, it was studied in 2019 and safety of camel women after 2 months of age.

3. Research results

Results of studies of milk productivity of camels in winter in different zones of south-west Kazakhstan are presented in the table 1.

In camel farms during the winter period of keeping camels only double milking during the day is used. It has been established that in the technology of milk production in camels, the average daily milk yield varies depending on the zones of their cultivation and the multiplicity of milking (double, triple).

The maximum indicators at the beginning of the winter period - in December, camels of the Arvan Arys-Turkestan breed camel rock, in particular the “Syzdykbekov A” farm, the average daily yield was 9.1 ± 0.6 kg, the “Usenov N.” 9.2 ± 0.5 kg, which is higher than the indicators of the “Korgan-NB” and the “Gulmayra” agricultural enterprises by 3.9 - 4.0 kg and 1.9 -2.0 kg, respectively (P<0.001). The fat content in milk varies slightly from 4.6 to 4.8%.

In subsequent months of lactation, milk yield decreases significantly, in January by 20-35%, in February by 60-85% to the level of the indicator for the month of December. On average, the milk yield in December - February for camels of Arvan breed was from 4.8 kg to 6.4 kg, with a mass fraction of fat in milk of 4.6 - 4.7%.

Thus, the genotypes of the dairy camels of the Bestarangylsky factory type of the “Syzdykbekov A” farm and the “Usenov N.” farm have a high productive potential compared with the peers of the “Korgan-NB” farm and the “Gulmyra” farm.

In winter, the milk yield of the Kazakh Bactrian camels in comparison with the peers of the Arvan breed of the Bestarangylsky plant type is 2.5 times lower, and the dairy herds of the Arvan of the k/s “Korgan-NB” and the k/s “Gulmayra” are 1.8 times.
### Table 1. Milk productivity of camels in winter.

| Zones               | Household            | Indicators                          | December | January | February | Total  |
|---------------------|----------------------|-------------------------------------|----------|---------|----------|--------|
|                     |                      | Milk yield per day                  | 9.2±0.5  | 6.5±0.4 | 3.2±0.3  | 6.3    |
|                     |                      | The fat content of milk, %          | 4.4±0.06 | 4.7±0.04| 4.7±0.05 | 4.6    |
|                     | "Usenov N."         | Milk yield per month                | 276      | 195     | 96       | 567    |
|                     |                      | Milk yield per day                  | 9.1±0.6  | 6.7±0.3 | 3.3±0.3  | 6.4    |
|                     | "Syzdybekov A"      | The fat content of milk, %          | 4.5±0.07 | 4.8±0.05| 4.8±0.06 | 4.7    |
|                     |                      | Milk yield per month                | 273      | 201     | 99       | 573    |
|                     | "Gulmayra"          | Milk yield per day                  | 6.2±0.4  | 5.3±0.4 | 2.9±0.3  | 4.8    |
|                     |                      | The fat content of milk, %          | 4.5±0.08 | 4.7±0.08| 4.7±0.06 | 4.6    |
|                     |                      | Milk yield per month                | 186      | 159     | 87       | 432    |
|                     |                      | Milk yield per day                  | 5.2±0.2  | 4.8±0.2 | 2.2±0.1  | 4.1    |
|                     | "Korgan-NB"         | The fat content of milk, %          | 4.8±0.06 | 4.8±0.05| 4.8±0.05 | 4.8    |
|                     |                      | Milk yield per month                | 156      | 144     | 66       | 366    |
|                     | "Kulandinsky"       | Milk yield per day                  | 2.8±0.3  | 2.5±0.2 | 1.7±0.2  | 2.3    |
|                     |                      | The fat content of milk, %          | 6.0±0.09 | 6.2±0.08| 6.2±0.09 | 6.1    |
|                     |                      | Milk yield per month                | 84       | 75      | 51       | 210    |
|                     | "Karanantubeke"      | Milk yield per day                  | 3.1±0.5  | 2.8±0.4 | 1.7±0.4  | 2.5    |
| Mangystau           |                      | The fat content of milk, %          | 5.7±0.05 | 5.9±0.07| 6.2±0.09 | 5.9    |
|                     |                      | Milk yield per month                | 93       | 84      | 51       | 228    |
|                     | "Zhana-tan"         | Milk yield per day                  | 3.0±0.3  | 2.8±0.3 | 1.8±0.2  | 2.5    |
|                     |                      | The fat content of milk, %          | 5.8±0.06 | 6.1±0.08| 6.3±0.08 | 6.1    |
|                     |                      | Milk yield per month                | 90       | 84      | 54       | 228    |
|                     | "Dastan Ata"        | Milk yield per day                  | 3.0±0.3  | 2.7±0.3 | 1.6±0.3  | 2.4    |
|                     |                      | The fat content of milk, %          | 6.0±0.07 | 6.1±0.07| 6.3±0.09 | 6.1    |
|                     |                      | Milk yield per month                | 90       | 81      | 48       | 219    |
| Karatau-Moyinkum    | "Bagdat"            | Milk yield per day                  | 3.0±0.3  | 2.6±0.2 | 2.1±0.2  | 2.6    |
|                     |                      | The fat content of milk, %          | 5.9±0.08 | 6.1±0.09| 6.2±0.09 | 6.1    |
|                     |                      | Milk yield per month                | 90       | 78      | 63       | 231    |
|                     | "Karakur"           | Milk yield per day                  | 3.0±0.3  | 2.7±0.3 | 2.2±0.2  | 2.6    |
|                     |                      | The fat content of milk, %          | 6.1±0.07 | 6.2±0.07| 6.2±0.09 | 6.2    |
|                     |                      | Milk yield per month                | 90       | 81      | 66       | 237    |
|                     | "Kazbek-Beck"       | Milk yield per day                  | 2.5±0.2  | 2.3±0.2 | 1.8±0.2  | 2.2    |
|                     |                      | The fat content of milk, %          | 5.9±0.06 | 6.2±0.09| 5.8±0.05 | 6.0    |
|                     |                      | Milk yield per month                | 75       | 69      | 54       | 198    |

Note: The values are given in percentage and are rounded to the nearest whole number. The total values are calculated as the sum of the values for December, January, and February.
It was found that the female camels of the Kazakh Bactrian in the first and second months of the winter period did not experience a sharp decrease in milk yield, and on average December 2.5 - 3.0 kg and January 2.3 - 2.8 kg. At the end of the winter period - in February it drops sharply and reaches the level of 1.6 - 2.1 kg. At the same time, the fat content of milk in the winter period is in the redistribution of 5.9 – 6.2%.

Thus, milk yield in winter is characterized by a decrease in the absolute indicator of the average daily milk yield with a simultaneous increase in the mass fraction of fat in milk in camels, regardless of the breed and the zone of their breeding.

Studies of the milk productivity of the camels of the Arvana and Kazakh Bactrian breeds showed that the annual milk yield varies widely, not only due to the breed and the region of their breeding, but also to the technology used (Table 2).

| Regions (zones) | Household (a)     | Average daily milk yield per 12 months | Fat, %     | Milk yield for 12 months, kg | Selected, heads |
|-----------------|-------------------|---------------------------------------|------------|-----------------------------|-----------------|
| Arwan           | "Usenov N."      | 9.6±0.3                               | 4.4±0.06   | 3223.7                      | 120             |
|                 | "Syzdykbekov A"  | 10.1±0.4                              | 4.3±0.08   | 3391.6                      | 86              |
|                 | "Gulmaya"         | 7.1±0.3                               | 4.3±0.05   | 2384.2                      | 55              |
| Priaral         | "Korgan-NB"      | 5.5±0.4                               | 4.7±0.06   | 1846.9                      | 38              |
|                 | On average        | 8.1±0.3                               | 4.4±0.06   | 2720.0                      | 299             |
| The Kazakh Bactrian camel | Milk yield not less than 2550 kg with a fat content of 4.2% |
| Priaral         | "Kulandinsky"    | 2.9±0.2                               | 5.8±0.05   | 920.9                       | 275             |
| Mangystau       | "Karagantubek"   | 3.1±0.3                               | 5.9±0.04   | 984.4                       | 78              |
| Near-Caspian    | "Zhana-tan"      | 3.1±0.3                               | 5.7±0.06   | 984.4                       | 172             |
|                 | "Dastan Ata"     | 3.0±0.2                               | 5.9±0.05   | 952.7                       | 85              |
| Karatau-Moyinkum| "Bagdat"         | 3.2±0.3                               | 5.6±0.06   | 1016.2                      | 95              |
| Near-Balkhash   | "Karakur"        | 3.2±0.2                               | 5.8±0.05   | 1016.2                      | 165             |
|                 | "Kazbek-Beck"    | 2.8±0.2                               | 5.6±0.06   | 889.1                       | 120             |
|                 | On average        | 3.1±0.2                               | 5.8±0.06   | 984.4                       | 990             |

In particular, in the technology of dairy camel breeding, where the bestrangylsky factory type of Arvan breed is used, the average daily milk yield for 12 months of lactation was significantly higher than the average for the breed. The annual milk yield averaged 3223.7 kg in the “Usenov N.” farm, and 3391.6 kg in “Syzdykbekov A”, which is higher than in the Gulmaya farm k/s “Korgan-NB” at 839.5-1007.4 kg and 1376.8 - 1544.7 kg.
In general, in the production of camel milk, effective breed is Arvana compared to the Kazakh Bactrian breed, where the annual yield in the accounted camel breeding areas is within 889.1 - 1016.2 kg and on average - 984.4 kg.

According to the results of studies of milk productivity of camels of Arvana and Kazakh Bactrian breeds for 12 months, 1,289 heads were selected in 11 farms of the south-western region of Kazakhstan, including Arvan breed camels with a minimum yield of 2.550 kg and 4.2% fat in the amount of 299 heads, Kazakh Bactrian with a yield of not less than 1500 kg and a fat content of 5.2% in the amount of 990 heads.

Under the conditions of “Baiserke -Agro” LLP, it was revealed that camels with a cup-shaped form of the udder (6.7±0.10 kg) produce significantly more milk compared to camels with round (5.2±0.17 kg), flat (3.9±0.28 kg) and lobular (3.5±0.15 kg) udder forms.

To assess the fecundity of camels of Kazakh Bactrian depending on the class and direction of productivity in the conditions of “Bayserke-Agro” LLP in Almaty region, camel-mattes from 6 years and older were involved in the object of study (table 3, 4).

**Table 3. Reproductive ability of adult females of the Kazakh Bactrian depending on the class.**

| Ser. No. | Indicators | Unit Meas. | 1 and 2 class | Out of class |
|----------|------------|------------|---------------|--------------|
| 1        | Paired     | heads      | 10 (100%)     | 10 (100%)    |
|          | for the 1st time | heads | 5 (50%)   | 7 (70%)   |
|          | for the 2nd time | heads | - | 3 (30%) |
|          | for the 3rd time | heads | 5 (50%) | 3 (30%) |
| 2        | Fertilized | heads      | 5 (50%)       | 3 (30%)     |
|          | in the 1st service | heads | 5 (50%) | 4 (40%) |
|          | in the 2nd service | heads | - | 3 (30%) |
|          | in the 3rd service | heads | 5 (50%) | 4 (40%) |
| 3        | Duration   | X±m, days | 425±2.5, 1.5, 2.9 | 438±4.5, 1.9, 4.3 |
|          | Fruiting of female paired in 2018. | Cv,% | 1.5 | 1.9 |
|          |           | δ, days | 2.9 | 4.3 |
| 4        | Threwed,   | heads    | 10 (11)       | 8 (10)      |
|          |           | %        | 90.9          | 80.0        |
| 5        | The safety of the young camels after 2 months | heads | 10 | 8 |
|          |           | %        | 100           | 100         |

There were studied such indicators as: the effectiveness of service in the 1st, 2nd and 3rd time; fertilization in the 1st, 2nd and 3rd service.

The analysis of the duration of fruiting in camels, paired in 2018. Additionally, the throwing of camels in 2019 and the camel's safety after 2 months of age were studied.

It has been established that in camels 1 and 2 of the assessment class for two mating fertility was 100%, in camels outside the class - 70%.

The average duration of fruiting of camels was 405 ± 2.5 days 1 and 2 with δ 2.9 days, and 438 ± 4.5 days outside for δ with 4.3 days.

In 2019, 90.9% camel threwed in class 1 and 2; 80% out of class.

It is established that the direction of productivity affects the main indicators of the reproductive ability of a camel. In particular, camels of the meat-wool direction of productivity have a 100% fertility rate after two services, and camels of meat and dairy direction of productivity had to service three times.
Table 4. Reproductive ability of adult females of the Kazakh Bactrian depending on the direction of productivity.

| Ser. No. | Indicators | Unit Meas. | Meat-coated | Meat and milk |
|----------|------------|------------|-------------|---------------|
| 1.       | Paired     |            |             |               |
|          | for the 1st time | heads | 15 (100%) | 5 (100%) |
|          | for the 2nd time | heads | 10 (66.7%) | 3 (60%) |
|          | for the 3rd time | heads | -      | 1 (40%) |
| 2.       | Fertilized |            |             |               |
|          | in the 1st service | heads | 5 (33.3%) | 2 (40%) |
|          | in the 2nd service | heads | 10 (66.7%) | 2 (40%) |
|          | in the 3rd service | heads | -      | 1 (20%) |
| 3.       | Duration   | X±m, days | 442±1.8    | 422±2.3 |
|          | Fructing of female paired in 2018. | Cv, %  | 0.9    | 1.4 |
|          |            | δ, days   | 1.7    | 2.1 |
| 4.       | Threwed,   | %         | 85.7   | 85.7 |
|          | months     |           |        |               |
| 5.       | The safety of the young camels after 2 months | %  | 100   | 100 |

Duration of fructing in camel meat-cutting areas of productivity averaged 442 days, meat and dairy - 422 days. That is, this is due to the fact that the camels of the meat and dairy direction of productivity had higher and higher average fatness compared to their peers from the meat-wool direction of productivity, among which were individuals of medium and lower average fatness.

The throw of camel in both meat and dairy and meat and dairy production was 85.7%. That is, the direction of productivity does not affect the rate of redundancy.

4. Conclusion

Based on the research work done to increase the volume of camel milk, we recommend to introduce milking technology into production using 12-month lactation. In particular, in the technology of dairy camel breeding, where the bestrangylsky factory type of Arvan breed is used, the average daily milk yield for 12 months of lactation was significantly higher than the average for the breed. The annual milk yield averaged 3223.7 kg in the “Ušenov N.” farm, and 3391.6 kg in “Syzdybekov A”, which is higher than in the “Gulmayra” farm k/s “Korgan-NB” at 839.5-1007.4 kg and 1376.8 - 1544.7 kg.

In general, in the production of camel milk, effective breed is Arvana compared to the Kazakh Bactrian breed, where the annual yield in the accounted camel breeding areas is within 889.1 - 1016.2 kg and on average - 984.4 kg.

According to the results of studies of milk productivity of camels of Arvana and Kazakh Bactrian breeds for 12 months, 1289 heads were selected in 11 farms of the south-western region of Kazakhstan, including Arvan breed camels with a minimum yield of 2550 kg and 4.2% fat in the amount of 299 heads, Kazakh Bactrian with a yield of not less than 1500 kg and a fat content of 5.2% in the amount of 990 heads.

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