

Original Research Paper

Creation of Smart Farms in the Herd Horse Breeding of Kazakhstan (Results of using Trackers)

¹Amin Richardovich Akimbekov, ²Rashit Bakitzhanovich Uskenov, ³Kairat Zhaleluly Iskhan, ⁴Tolegen Shonaevich Assanbayev, ²Tlekbol Sungatovich Sharapatov and ^{1,2}Dastanbek Asylbekovich Baimukanov

¹Department of Animal Husbandry, Veterinary Medicine and Feed and Milk Quality Assessment, Research and Production Center for Livestock and Veterinary Medicine Limited Liability Company, Kazakhstan

²Department of Technology for the Production and Processing of Livestock Products, NJSC S. Seifulin Kazakh Agrotechnical University, Kazakhstan

³Department Physiology, Morphology and Biochemistry, named after Academician N.U. Bazanova, Kazakh National Agrarian Researcher University, Kazakhstan

⁴Department of Zootechnologies, Genetics and Breeding, NJSC Toraigyrov University, Kazakhstan

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Corresponding Author:

Dastanbek Asylbekovich Baimukanov

Department of Animal Husbandry, Veterinary Medicine and Feed and Milk Quality Assessment, Research and Production Center for Livestock and Veterinary Medicine Limited Liability Company, Kazakhstan

and

Department of Technology for the Production and Processing of Livestock Products, NJSC S. Seifulin Kazakh Agrotechnical University, Kazakhstan
Email: dastanbekbaimukanov@gmail.com

Abstract: The aim of the research is with a help of trackers to ensure round-the-clock observation of the herd and its safety, especially in winter bad weather, to facilitate the work of herd horse breeders. The object of the study was the offspring of local Kazakh horses from Nauan farm of the Aksuat district, the East Kazakhstan region, LLP agricultural firm "Akzhar ondiris" of the Pavlodar region of the Republic of Kazakhstan. The technology of their maintenance is year-round grazing, with minimal contact with a person. When using trackers, the distance covered by horses during grazing (in winter, spring), as well as the daily frequency and duration of rest of herd horses in the time interval from 18:00 to 06:00 was monitored. Number of observations is 4-8. Observations with the help of trackers made it possible to establish that in the Nauan farm in December, horses travel 18,500 m, in January 13,150 m, in February 11,310 m, in March 10,950 m, and in April 8,860 m. For 12 h of grazing, a herd of horses passes 6200-7000 m in December, 8000-10000 m in January, 10000-15000 m in February, 6000-8000 m in March. However, due to the fact that a sharply continental climate prevails in our republic and weather conditions changes, the dynamics of grazing can change dramatically in one direction or another, especially during critical periods of the year. The highest average daily gains in colts were observed in 6-month-old young animals (780-860 g) in comparison with 18 (704.3-789 g) and 30 (667.1-690 g) monthly colts.

Keywords: Horse Breeding, Smart Farm, Trackers, Monitoring, Behavior, Pastures

Introduction

In connection with the transition to intensive animal husbandry, "zootechnic ethology" is becoming in demand in the context of digitalization and the use of new technologies for production. Proceeding from this, the importance of behavior, for the manifestation of maximum productivity, the realization of the genetic potential is a priority in the assessment and selection.

In herd horse breeding, the knowledge gained in ethology will make it possible to create the necessary conditions in industrial complexes and farms.

Knowledge regarding the peculiarities of the herd behavior of animals, their feeding behavior during the grazing period is of great practical importance to facilitate the management of animals, reduce labor costs and financial resources in the unit production, and increase productivity through selection based on behavioral traits.

Productive horse breeding in Kazakhstan, Bashkortostan, Eastern Siberia is a promising, developing, and highly efficient livestock sector (Demin and Khotov, 2021a).

In terms of meat productivity, horses are not inferior to specialized breeds of cattle. The slaughter yield in

horses reaches 52-60%, and the meat yield in carcasses is 81-82% (Kargayeva, 2020a).

Meat has a high nutritional value due to a complete set of essential amino acids and a favorable ratio between them, as well as the presence of biologically valuable fat in it. Horse meat is recognized as a dietary food product (Kargaeva, 2020b; Zaycev and Koveshnikov, 2021).

For these purposes, local Kazakh horses are widely used, which are the most valuable breeding material for the production of horse breeding products (Raspa *et al.*, 2020).

The Kazakh horse is diverse: In the eastern regions it is close to the Mongolian and Tuvan, in the southern and southwestern regions, it is close to the Aday offspring, in the central regions it is close to the steppe horse (Rzabaev *et al.*, 2011; Mongush *et al.*, 2020).

Favorable opportunities for the horse breeding are available in all regions of Kazakhstan. The presence of large areas of natural fodder lands, where it is possible to keep horses on pasture all year round, contributes to the development of productive horse breeding and obtaining cheap products.

However, the effectiveness of meat horse breeding in the areas of herd-keeping of horses is constrained by the fact that the local Kazakh horses of these areas do not have a high enough live weight, are small, and late, as they finish their growth by 6-7 years. At the same time, local Kazakh horses are well adapted to the severe conditions of winter grazing. Therefore, the development of meat horse breeding in herd-keeping areas is associated with the problem of improving the meat qualities of local Kazakh horses (Demin and Khotov, 2020b).

One of the methods of increasing the live weight and meat productivity of horses is feeding and fattening.

The Aim of Research

Using trackers to ensure round-the-clock observation of the herd and its safety, especially in winter bad weather, to facilitate the work of herd horse breeders, as well as the study of feeding qualities and meat productivity of stallions of different ages during the autumn fattening.

Materials and Methods

The object of research is Kazakh horses from the farm "Nauan" of the East Kazakhstan region, LLP agricultural firm "Akzhar ondiris" of Pavlodar region. The technology of their maintenance is year-round grazing, with minimal contact with a person.

When using trackers, the distance covered by horses during grazing (in winter, spring), as well as the daily frequency and duration of rest of herd horses in the time interval from 18:00 to 06:00 was monitored.

Used GPS trackers:

1. Globalstar SmarTone C satellite GPS tracker

2. Satellite GPS tracker SPOT Trace
3. GPS tracker Neomatica ADM50

For the Globalstar SmarTone C tracker, the time interval for sending data to each device is 8 h. For the SPOT Trace tracker, the time interval for sending data is 1 h. For the Neomatica ADM50 tracker, the time interval for sending data is 8 h.

For the experiments, three groups of stallions aged 6, 18, and 30 months were allocated for autumn fattening. The technology of keeping young animals in the farm Nauan was typical for the breeding area of herd horses. The keeping way of young horses during fattening was grazing without feeding. Autumn feeding was carried out from October 11 to December 19, 2021, i.e., 70 days on feather grass-fescue-wormwood pastures (Alimaev *et al.*, 2014).

When setting up and at the end of feeding, all experimental colts were weighed. The increase in live weight during the fattening period and the ability to bait were determined by weighing every 10 days (Instructions for bonitation of local breeds of Kazakhstan, 2014).

Before setting up experiments on fattening, individual weighing of colts on one-ton scales, recording brand numbers, determining the age and fatness of colts were carried out. Fatness was determined in accordance with the requirements of GOST 32225-2003.

When studying the meat qualities of stallions of different ages, a control slaughter was done at the slaughterhouse of the Nauan farm using the method of the All-Russian Research Institute of Horse Breeding and in accordance with the technological instructions (Kargaeva, 2020b; HS, 2003). Horse meat and foal in half carcasses and quarters, 2003, accepted in the meat industry.

For a more objective assessment of the marketability of meat, horse carcasses were cut based on the scheme adopted for the state trade network of the Republic of Kazakhstan according to ST RK 1303-2004 (Kargayeva, 2020a). Each of the cuts resulting during the cutting of horse carcasses has a specific purpose. The fat neck comb was used to make zhal. The posterior costal part (from ribs 7 to 12) with pulp was used to make kazy. The upper layer of muscle tissue with fatty watering from the hip part was used to make zhaya product. The muscle tissue of the neck and humeroscapular part with the addition of internal fat was used to produce chuzhuk. Karta was prepared from the small colon. The data obtained in the experiments were processed biometrically (Baimukanov *et al.*, 2018).

Results

When observations were made, the air temperature in the "Nauan" farm in December was -13°C by 6 pm, -22°C at 6 am in the morning. The thickness of the snow cover in December was 4-7 cm. It was found that the number of rest pauses was 2. The average duration of rest for 1 pause was

33-36 min-sec in December, 50-25 min-sec in January, 1-00-27 h-min-sec in February, 55-13 in March min-sec (Table 1).

In LLP agricultural firm "Akzhar ondiris" the air temperature during the observations was -10°C by 18:00, -7°C at 06:00 in the morning. The thickness of the snow cover in December was 5-6 cm. It was found that the number of rest pauses was 2, the average duration of rest per 1 pause was 1 h 35 min. In January, the thickness of the snow cover increased to 10-15 cm, in February 15-20 cm, with a further decrease in March to 2-3 cm. The duration of rest for one pause was 1 h 16 min 58 sec in January and 1 h 40 min 08 sec in February. In March, the air temperature was at 18:00 - 5C, at 06:00 -2C, the average duration of rest for 1 pause was 1 h 54 min 32 sec. Observations with the help of trackers made it possible to establish that in Nauan farm in December, horses travel 18,500 meters, in January - 13,150 m, in February 11, 310 m, in March 6,200 m, and in April 8, 860 m.

In LLP agricultural firm "Akzhar ondiris" for 12 h of grazing, a herd of horses travels 6200-7000 m in December, 8000-10000 m in January, 10000-15000 min February, 6000-8000 m in March. However, due to the fact that a sharply continental climate prevails in our republic and weather conditions can change dramatically, grazing dynamics can change in one direction or another, especially during critical periods of the year (Table 2).

Feeding horses is one of the most important economic activities that allows you to increase the production of horse meat and improve its quality by grazing on natural pastures (Kargayeva, 2020a-b).

During the autumn fattening of young horses, home-made collars with trackers attached to them were put on the necks of two colts to monitor the intensity of pasture forage consumption through a computer, as well as their behavior during the autumn feeding period.

Feeding was carried out on grass-forb associations. Fescue (*Festuca sulcata*), Austrian wormwood (*Artemisia austriaca*), bulbous bluegrass (*Poa pulbosa*), noble yarrow (*Achillea nobilis*), and other plants.

Long-term observations of young animals during fattening showed that the main feature of their behavior is a minimum of movement. Moreover, the movement itself was caused by the need to move to a fresh piece of pasture. The distance traveled by young horses in 10 h on a pasture during feeding at night was 4570 m in October 2690 m in November, and 1500 m in early December. One of the special forms of behavior of horses during fattening was the frequency of their rest. Observations were carried out for 12 h on similar days on moonlit nights. During the night fattening, the young animals rested three times. The night rest for the grazing young came at certain hours, and its duration varied insignificantly.

So, in October, the stallions rested for the first time between 22 and 24 h, the second between 2 and 3 h, and the third between 4 and 5 h. In November, those reactions set in practically at the same time. In December, rest came between 20 and 21 h, 24 and 01 h, and before dawn between 6 and 7 h.

The onset of rest in young horses during fattening was peculiar. The colts grazed intensively, then 1-2 colts stopped eating pasture food and after 5-7 min they were all asleep. After 30-40 min, sometimes even an hour, some foal resumed grazing, and after a few minutes, all the colts began to graze. Young animals at the age of six months dozed lying down, and colts of 18 and 30 months of age dozed standing up.

Using the biological features of herd horses and feather-grass-fescue-wormwood pastures of the steppe zone of the Aksuat district of the East Kazakhstan region, we have increased the production of horse meat, increased the fatness of colts. In the summer, due to the heat and the large number of blood-sucking insects, horses lose their fatness. In the autumn period, with precipitation, the secondary vegetation of cereal and wormwood associations occurs. During this period, we carried out autumn feeding, the results of which are shown in Table 3.

The research results showed that in the autumn period, young horses of all groups had a high gain in live weight. In 6- and 18-month-old colts, gains increased mainly due to the growth of muscle tissue, and in 30-month-old colts due to muscle tissue, as well as due to the deposition of adipose tissue. The highest average daily gains in colts were observed in 6-month-old young animals (780-860 g) in comparison with 18 (704.3-789 g) and 30 (667.1-690 g) monthly colts.

It was established that during the first 20 days of feeding (from October 11 to October 30), when the secondary vegetation begins, the stallions of all three age groups quickly increase in live weight. The nature of the curve of average daily gains in live weight in all three groups of young animals was almost the same. Slightly high average daily gains for the first 20 days of fattening are observed in 6-month-old colts 1408 g and 18-month-old young animals 1205 g. In 30-month-old young animals, this figure was 1060 g. At the end of fattening, average daily gains reached 30.20 and 15 g per day.

The high average daily gains of young horses for the first 20 days of fattening are explained by the ability of horses to quickly compensate for weight loss in a relatively short period of time during the herbage period, which has increased nutritional value. When the horses reached above-average fatness, the average daily gains decreased to 15-30 g per day.

At the end of the autumn fattening, 2 animals were selected from each group for control slaughter, with a live weight indicator close to the average data for the groups. Control slaughter data are given in Table 4.

It was found that 30-month-old colts exceeded the young 6- and 18-month-old colts by 34.2 and 13.1% in terms of carcass weight. The highest slaughter yield (56.8%) had stallions of 6 months of age, with a gradual decrease with age. The value of the slaughter yield depends on the size and volume of the gastrointestinal tract, especially in horses kept all year round in grazing-tebenevok conditions.

Table 1: Daily frequency and duration of rest for herd horses from 6 pm till 6 am in winter (when using the tracker)

Farm	Observations	Number of rest breaks	Air temperatures, OC		Average duration of rest for 1 pause, hour-min-sec	Snow cover thickness, cm
			6 pm	6 am		
December						
Nauan	2	2	-13	-22	0-33-36	4-70
LLP agricultural firm "Akzhar ondiris"	2	2	-10	-7	1-35-00	5-60
January						
Nauan	3	3	-15	-22	0-50-25	6-80
LLP agricultural firm "Akzhar ondiris"	3	3	-13	-22	1-16-58	10-15
February						
Nauan	3	3	-12	-19	1-00-27	10-12
LLP agricultural firm "Akzhar ondiris"	3	2	-14	-22	1-40-08	15-20
March						
Nauan	2	3	-6	-10	0-55-13	5-70
LLP agricultural firm "Akzhar ondiris"	2	2	-5	-2	1-54-32	2-30

Table 2: Distance traveled by horses during 12 h of grazing, in winter (when using a tracker)

Farm	Number of Observations	Distance traveled by one herd during grazing, m	Air temperature during the observation period, °C	Snow cover thickness, cm
Nauan	8	18500	-13, -22	7
LLP agricultural firm "Akzhar ondiris"	5	6200-7000	-7	5-6
January				
Nauan	4	13150	-14, -22	6
LLP agricultural firm "Akzhar ondiris"	fo4ur	8000-10000	-7, -15	5-10
February				
Nauan	6	11310	-12, -22	5
LLP agricultural firm "Akzhar ondiris"	4	10000-15000	-10-20	10-15
March				
Nauan	4	6200	-6; -ten	5-7
LLP agricultural firm "Akzhar ondiris"	4	6000-8000	-2; -5°C	2-3

Table 3: Results of the autumn fattening of young horses (n = 15)

Indicators	Age in months		
	6	18	30
Nauan			
fattening duration, days	70.0	70.0	70.0
Live weight at the beginning of fattening, kg	164.6±01.58	268.2±02.18	312.4±02.97
Live weight at the end of fattening, kg	219.2±02.27	317.5±02.55	359.1±03.01
Live weight gain, kg	54.6±00.89	49.3±00.95	46.7±01.02
Average daily gain, g	780.0±10.85	704.3±11.76	667.1±12.09
LLP agricultural firm "Akzhar ondiris"			
fattening duration, days	70.0	70.0	70.0
Live weight at the beginning of fattening, kg	175.4±1.41	290.3±1.17	341.6±00.81
Live weight at the end of fattening, kg	235.6±1.40	345.5±1.63	389.9±01.03
Live weight gain, kg	60.2±0.56	55.2±0.62	48.3±00.71
Average daily gain, g	860.0±8.50	789.0±9.20	690.0±10.30

Table 4: Results of the controlled slaughter of colts

Indicators	Age in months		
	6	18	30
Nauan			
Preslaughter live weight, kg	220.0	316.0	358.0
Carcass weight, kg	125.0	165.0	190.0
Slaughter yield, %	56.8	52.2	53.1
The pulp in the carcass, kg	98.0	133.0	151.0
Pulp percentage, %	78.4	80.6	79.5
Bones in the carcass, kg	27.0	32.0	39.0
Percentage of bones, %	21.6	19.4	20.5
LLP agricultural firm "Akzhar ondiris"			
Preslaughter live weight, kg	228.6	335.1	378.3
Carcass weight, kg	126.9	176.6	213.0
Slaughter yield, %	55.5	52.7	56.3
The pulp in the carcass, kg	105.7	146.6	177.8
Pulp percentage, %	83.3	83.0	83.5
Bones in the carcass, kg	17.9	25.3	31.5
Percentage of bones, %	14.1	14.3	14.8

In Nauan farm, pulp yield in carcasses of 18- and 30-month-old horses is 35 kg (35.7%) and 53 kg (54.1%) higher compared to 6-month-old colts. According to the absolute content of bones in the carcasses of 18- and 30-month-old colts, it was more than 32 and 39 kg, however, according to the relative content of bones in 6-month-old colts, these figures were higher by 2.2 and 1.1%. In terms of pulp yield per 1 kg of bones, 18-month-old colts (4.1 kg) had the advantage, then 30-month-old colts (3.9 kg), and the lowest pulp yield per 1 kg of bones was observed in 6-month-old colts (3.6 kg).

In LLP agricultural firm "Akzhar ondiris" slaughter yield was 55.5% for 6-month-old foals, 52.7% for 18-month-old foals, and 56.3% for 30-month-old foals.

Discussion

The use of GPS trackers in the herd horse breeding of Kazakhstan allowed, within the framework of a scientific and technical program, to study the behavior of horses during the day on natural pastures.

The results allowed us to determine:

1. Daily frequency and duration of rest for herd horses from 6 pm till 6 am in winter (when using the tracker)
2. Distance traveled by horses during 12 h of grazing, in winter (when using a tracker)
3. Results of the autumn fattening of young horses
4. Results of the controlled slaughter of colts

Conclusion

When using the tracker, the distance traveled by horses during 12 h of grazing in winter was determined, as well as the daily frequency and duration of rest of herd horses in the time interval from 6 pm till 6 am. The results showed that trackers do not affect the behavior of herd horses on natural fodder pastures in the winter season.

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Author's Contributions

Amin Richardovich Akimbekov: Performer, analysis of research results.

Rashit Bakitzhanovich Uskenov: Performer, analysis of research results.

Kairat Zhaleluly Iskhan: Responsible executor.

Tolegen Shonaevich, Assanbayev and Tlekbol Sungatovich, Sharapatov: Contractor, conducting experimental research.

Dastanbek Asylbekovich Baimukanov: The author of the idea, head of the event, generalization, preparation of the manuscript.

Ethics

When conducting research work, all principles of scientific ethics are observed. There is no conflict of interest.

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