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Analysis of economic efficiency of livestock in the Republic of Tuva

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Abstract. As thousands of years ago, now Tuvan arats-pastoralists keep seven types of livestock (sheep, goats, cows, horses, yaks, camels, deer), each of which takes a certain place in the diet of population. The natural areas of Tuva are perfect for transhumance. Reforms in the 1990s led to the collapse of state farms, in the absence of work in rural areas, the population engaged in the Tuvan traditional type of livestock breeding – transhumance, mainly sheep, goats and cattle of local breed. For a large number of the rural population of Tuva, animal husbandry has become a socially important and vital activity. Now there are more livestock in Tuva than during the industrialization of agriculture in Soviet times. However, Tuva has not developed an effective mechanism for the sale of livestock products and its further processing which would increase the income of shepherds' families. For the first time on the basis of the complex analysis of animal husbandry in Tuva the structure of expenses and income of an average livestock farm is defined, also its economic efficiency is calculated. It was concluded that animal products, such as milk, wool and skin, economically viable in the Soviet period, currently do not generate income because of absence of organized animal products collection points, and the economic efficiency of livestock farms nowadays is achieved only through the production of ovine and bovine meat.

1. Introduction

In the 80s, all the state farms of the Tuvan ASSR achieved significant level of industrialization of the agro-industrial complex, including livestock. In those years, each state farm had on average of about 20 herds of sheep or goats, including a herd of rams on average with of 500 heads, and the relevant sheep-breeding facilities. Also in a rural settlement there was a dairy farm keeping 200-300 cows and at least one herd of horses. All winter sheepfolds in the central regions of the autonomous republic were connected to the grid. The collapse of the USSR and further political reform of the 1990s led to the destruction of economic relations between the union, autonomous republics, territories and regions of the former USSR in all spheres of the economy and the destruction of state farms. At that time, property, livestock, dairy farms, livestock facilities and machinery were privatized. Because of the lack of effective management, privatized agricultural property was sold for parts as building materials, machinery, livestock, and meat. In the absence of work in rural areas, part of the population engaged in traditional Tuvan cattle breeding, mainly sheep and goats of local breed. Due to the cessation of breeding works and raising productive species of cattle such as Simmental breed, small cattle (Merino) and horses of the Oryol breed, all households and farms of the republic gradually switched to Tuvan breeds of



domestic animals adapted to the local climate and poor fodder base. In view of the foregoing, the end of 90-ies of the last century can be considered as the beginning of the revival of traditional nomadic way of animal breeding in Tuva.

2. Models and Methods

The study was carried out on the basis of observation of shepherd settlements by a team of teachers of the Department of economics and management of the Tuvan State University during the fieldwork in August 2018 using the regional Russian Fund of Basic Researches grant *Transport infrastructure as a factor of socio-economic development of the border regions of the Republic of Tuva* [1]. We used the method of analysis to determine the indicators of the agro-industrial complex of the region, the statistical model was used in the calculations of the needs of a sheep herd for feed, water, area of a winter sheepfold and the *Grand-smeta* program was used to determine the estimated cost of the construction of sheep-breeding facilities.

2.1. Analysis of the agro-industrial complex of Tuva

Agriculture is the main branch of the economy of the Republic of Tuva, which employs more than 10 thousand people. 148.4 thousand people live in rural areas (January 1, 2019), or 45 % of the total population.

According to preliminary data, gross agricultural output in 2018 amounted to 6,064.7 million rubles with a volume index of 105.2 % (in Russia – 99.4 %, in the Siberian Federal District – 101.1 %), including animal husbandry – 102.9 %, crop production – 117.4 % [2]. The structure of agricultural production is dominated by livestock production – 83%, crop production – 17 %. [3].

It should be noted that Tuva among the subjects of the Siberian Federal District occupies a leading place on the number of livestock per capita. According to the Livestock department of the Ministry of agriculture and food of Republic of Tuva, as at 1 January 2018, the number of all types of livestock in all categories of farms amounted to 163.8 thousand heads (1.1 % higher than in 2017): 72.0 thousand cows (1.1 % growth), 1157.3 thousand sheep and goats (8.7 % growth), 80.8 thousand horses (1.7 % growth), 11.9 thousand yaks , 0.271 thousand camels, and 3.65 thousand deer. 60 % of all types of livestock belong to households.

2.2. Characteristics of the object of the research

On the basis of our observations conducted during the field studies in the border areas of Mongun-taiga, Ovrur, Tes-Khem, and Erzin regions of Tuva in the summer 2018 it was found that the optimal number of sheep and goats in a herd is considered to be 500 heads. In Tuva, the main type of livestock is small cattle. At the same time, it should be noted that the size and composition of cattle breeding depends on the number of household members as well as on the geographical location of the area of residence. The number of goats in the total herd does not exceed 20% or 60-100 heads. As a rule, a sheep-breeding settlement has 3-5 horses and 5-10 cows, excluding oxen, young cattle (two-year-old bulls and heifers) and calves. The same species composition and number of cattle, which Tuvinians kept, was recorded in the S I Vainshtein's works [4, 5]. This indicates the preservation of historical experience of animal breeding.

Horses play an important role in both animal husbandry and in the life of the Tuvan cattle breeder in general. First, they are means of transportation when grazing sheep, cows and other animals; secondly, they pull carts and sleds when doing chores; thirdly, they are means of transportation over long distances. Thus, a herder must have at least one horse. Cows are kept mainly for milk to produce traditional dairy products and oxen for meat for sale.

The purpose of the study is to determine the economic efficiency of sheep farming on the example of the average sheep breeding settlement without taking into account its legal status (state unitary enterprise, municipal unitary enterprise, agricultural consumer cooperative, peasant farm and household farm).

3. Results and Discussion

Tuvan short-fat-tailed sheep of meat-fat breed is considered one of the oldest breeds in the world. Experts note the following features of the Tuvan breed [6]: endurance, ability to travel long distances; adaptability to the local climate and poor fodder base.

Tuvan sheep easily get over hot summers, cold winter and are undemanding to feed. Being content with scarce vegetation, they are able to gain weight and maintain it. Animals easily traverse great distances without water. To satisfy the need of drinking, Tuvan sheep eat snow in winter. They easily climb the mountain slopes and descend from them. One of the important advantages of the breed – ewes show excellent maternal qualities.

In traditional transhumance in Tuva, all groups of livestock are pasture-raised since this system implies year-round grazing. In winter, supplemental feeding, which usually includes coarse and concentrated feed, is carried out for ewes during the lambing season and weakened animals as well as in case of cold and snowy winter. The amount of harvested hay depends on the duration of stay in a winter sheepfold, as a rule, it lasts from November to April, and lambing is planned from February to March. Therefore, the determination of feed stock, bedding and water requirements for the lambing period is very important. On the basis of the guidelines for technological designing of sheep breeding facilities we defined daily needs of the herd of Tuvan short-fat-tailed sheep of meat-fat breed in terms of stock feed, water and bedding [7]. The calculations are given in the Table 1. For calculations we used the average size of livestock kept by farms of all categories. Free mating is practiced in traditional animal husbandry.

With this method of insemination a ram can mate 30 to 40 ewes. In our example, 15 rams breed with 300 ewes. In order to regulate the time of lambing, herders keep rams separated from ewe herd in the off season. On average, each of the 17 municipal districts of the republic has 2 herds of rams. The costs of raising rams are not included in this calculation because they are separated after the mating period.

Table 1. Daily requirement of a herd of Tuvan short-fat-tail sheep of meat-fat breed in feed, water and bedding^a.

Animal group	Herd size, heads	Average daily requirement per animal						Daily herd requirements					
		Housing, m ²	Feed, kg	Water, L	Bedding, kg	Urine, L	Feces, kg	Housing, m ²	Feed, kg	Water, L	Bedding, kg	Urine, L	Feces, kg
Ewes	300	1.2	0.8	5.0	0.30	1.0	2.5	360	240	1,500	90	300	750
Young stock	200	0.7	0.6	4.0	0.15	0.5	1.5	140	120	800	30	150	300
Lambs older than 45 days	100	0.4	0.4	1.5	0.15	0.3	1.0	40	40	150	15	90	100
Total	600	2.3	1.8	10.5	0.60	1.8	5.0	540	400	2,450	135	540	1,150

^a **Note:** The calculation is based on the Guidelines for the technological designing of sheep-breeding facilities RD-APK 1.10.03.02-12.

Taking into account the required size of sheep-breeding facility (a winter sheepfold) of 540 m², the production and storage facilities of 1080 m², we made the sample project which allowed us to calculate the estimated cost of construction of sheep-breeding facility amounted to 1550 thousand rubles. The calculations of the estimated cost were made in the *Grant smeta* program. It is supposed that a solar panel is installed with a cost of 400 thousand rubles for the lightning of the winter sheepfold and the connection of the required electrical appliances; drilling a water well with a depth of 40 m is done (3000 rubles/m), and also a depth pump is installed (18000 rubles) to provide the winter sheepfold with drinking water. The area occupied by the winter sheepfold should not exceed 5 hectares but agricultural land, particularly for pasture and hayfields, are not limited, but its size is usually about 100 hectares. In our example, 3 people engage in animal husbandry.

The structure of commercial livestock products is presented in the Table 3. Valuation of livestock commodity products was made in accordance with market prices as of 2019.

Table 2. Daily requirement of a herd of Tuvan short-fat-tail sheep of meat-fat breed in feed, water and bedding during lambing period since February to April^a.

Animal group	Herd size, heads	February, 28 days providing 20% of heads			March, 31 days providing 70% of heads			April, 30 days providing 10% of heads		
		Feed, ton	Water, thousand L	Bedding, ton	Feed, ton	Water, thousand L	Bedding, ton	Feed, ton	Water, thousand L	Bedding, ton
Ewes	300	1.400	8,400	0.500	5.20	32,550	1.900	0.72	4,500	0.270
Young stock	200	0.670	4,480	0.160	2.52	24,800	0.650	0.36	2,400	0.090
Lambs older than 45 days	100	0.224	840	0.084	0.87	3,255	0.325	0.12	450	0.045
Total	600	2.300	13,720	1.744	8.59	60,605	2.900	1.20	7,350	0.405

Total need for feed, water and bedding for three months lambing period will be:

Hay, ton – **12.1**

Water, L – **81,675.0**

Bedding (straw), ton - **5.0**

Salt-lick, ton – **0.5**

Required place for sheep-breeding facilities, m² – **540.0**

^a **Note:** The Table 2 is based on the daily requirements for a herd given in the Table 1.

Table 3. Structure of annual commercial livestock products.

Commodity output	Unit of measurement	Quantity	Value, thousand rubles		% of total
			per unit	total	
Milk (10 liters per day. The amount of milk is determined for three months)	L	9,000	0.020	180	20.800
Wool (coarse) 1.5 kg per sheep	kg	750	0.024	18	2.100
Cattle meat (3 oxen of Tuvan breed with average weight 180 kg)	kg	540	0.180	97.2	11.200
Lamb meat (the average weight of a wether is 30 kg, meat of 5 wethers is used for sale)	kg	150	0.3	45	5.200
Sheep meat (average weight of a sheep is 18 kg, meat of 10 sheep is used for sale)	kg	180	0.3	54	6.200
Live wethers	head	10	7.0	70	8.100
Live sheep	head	40	5.0	200	23.100
Live young stock	head	50	4.0	200	23.100
Cattle skin (the average weight of ox skin is 25 kg)	kg	75	0.003	0.23	0.026
Total, including				864.43	100.00
- for own consumption				173.00	20
- for sale				691.43	80

The most significant items of income are: the sale of live sheep (23.1 %), live young stock (23.1 %); the sale of milk (20.8 %); the sale of cattle meat (11.2 %); the sale of live wethers (8.1 %). Commercial products can be sold in the amount of 691.43 thousand rubles.

Although the sale of milk is profitable, there are no milk reception centers in Tuva where pastoralists could sell surplus milk. Therefore, this item of income as lost profit will not be taken into account in the determination of the economic efficiency of cattle breeding. It should also be noted that there is no organized hides and skins market, and therefore animal skin, especially small cattle and horses, is usually thrown into the landfill. The Table 4 given below defines the annual cost of sheep breeding.

Table 4. Structure of the annual costs of sheep breeding.

Types of work	Unit of measurement	Quantity	Value, thousand rubles		% of total
			per unit	total	
Grazing (12 months) (11,280 rubles per month – a minimum wage in Tuva in 2019 [8])	person	3	11.3	406.1	70.30
Veterinary treatment, including				58.3	10.10
- diagnostic test of cattle	head	20	0.1	2.0	
- diagnostic test of small cattle	head	500	0.1	50	
- diagnostic test of horses	head	5	0.17	0.85	
- prevention of white muscle disease of lambs	head	100	0.002	0.2	
- dehelminthization of small cattle (without lambs)	head	500	0.006	3.0	
- dehelminthization of cattle	head	20	0.012	0.24	
- Diazinon-C (spraying twice a year)	head	520	-	2.0	
Feed, including				78.2	13.50
- roughage,	ton	12.1	2.0	24.2	
- forage,	ton	3	8.0	24.0	
- hay,	ton	5	6.0	30.0	
- salt-lick.	ton	0.5	0.015	0.0075	
Maintenance of the solar cells		2	3.0	6.00	1.03
Additional workers during the slope period (1 month) 11,280 rubles/month	person	2	11.3	22.56	3.90
Agricultural land rent	ha	100	-	6.50	1.12
Total				577.66	100.00

The highest costs in livestock breeding activity are cattle grazing (70.3 %), fodder (13.5 %) and veterinary treatment (10.1 %). The total cost is 577.66 thousand rubles.

Financial results of the farm for 2019 are presented in the Table 5. As the main criterion of economic efficiency of animal husbandry the level of profitability is accepted.

Table 5. Financial results of a livestock farm in 2019.

Indicators	Value
Commodity output, thousand rubles (without milk sales)	684.43
Production costs, thousand rubles	577.66
Profit, thousand rubles	106.77
Profitability of animal production, %	18.40

4. Conclusion

The calculations led to the conclusion that, if properly managed, it is possible to organize economically efficient livestock husbandry producing high-quality and environmentally friendly products in the Republic of Tuva. To improve the economic efficiency of livestock in Tuva, it is necessary to develop purchase facility of surplus milk produced by pastoralists as well as to organize reception points of skins of small cattle and horses; this will bring livestock products to the market and ultimately increase the income of shepherds' families.

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