Status and Development Prospects of Horse Breeding in the Altai Region

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Abstract. The transition to a market economy caused significant changes in the number of horses and their distribution by category of horse owners, regions, and economic use areas. This study aims to identify the natural and economic factors affecting the quantitative and structural features of the horse breeding industry in the Altai region. More than that, the research discusses critical parameters of its optimal development in the medium term. In 1991-2018, in Altai, the horse population decreased from 226.8 to 161.3 thousand heads (28.9%). However, due to higher decreases of horse livestock in other Russian regions, the share of Altai horse owners in the Siberian Federal District increased from 34.0 to 38.5%. The country-wide share increased from 8.7% to 12.6%. While the number of horses in the Altai Krai decreased 2.6 times, in the Altai Republic, it increased by 28.9 thousand heads, exceeding the pre-reform level by 38.3%. Until 2025, with the stabilization of the number of workhorses, meat horse breeding will be the central development area. The number of meat horses will increase in Altai from 112.6 to 126.8 thousand heads, which, with rational management, would ensure the production of over ten thousand tons of high-quality meat for domestic consumption and export.

Keywords: Number of horses · Altai regions · Economic growth · Trends · Parameters · Prospects

1. Introduction
The horse-breeding industry of the country saw significant losses during the transition to the market economy. The number of horses in the country in 1991–2018 decreased from 2,618.4 to 1,283.0 thousand heads (more than 2 times). As a result of market variability and privatization, most of the horse stock passed from agricultural enterprises to private ownership: population, farmer households, and individual entrepreneurs [3].

As of the beginning of 2019, there were 638.7 thousand horses (49.8%) in private ownership of the population, 372.3 thousand (29.0%) in farms, and individual entrepreneurs, while only 271.9 thousand (21.2%) were in agricultural organizations. In 1990, agricultural organizations had 90% of the horse population [7].

The country-wide placement of the horse-breeding industry changed considerably. Over the years of reform, the shares of Siberian and Far Eastern Federal Districts increased from 49.3% to 59.6% of the total Russian livestock, while the share of Central and Northwestern Districts decreased from 14.8% to 3.7% [5].

Altai horse owners have 161.3 thousand horses, 38.5% of the livestock in Siberian Federal District, and 12.6% of the all-Russian livestock. Meat herd horse breeding is a sizeable specialized industry,
created in agricultural organizations and peasant farms in the region. These enterprises own around 79.8 thousand horses, accounting for 54% of the total number of meat livestock in the district.

Given the significant horse resources of Altai, studies on the development trends and the main development vectors are extremely relevant.

2. Materials and Methods
The primary research material was the statistical data on horse stock by category of horse owners and regions. We also used the data of complex expeditionary surveys of breed composition in the horse stock, organization technology, and practical horse breeding (1972–1973 and 2007–2008). Moreover, we analyzed secondary literature on the topic.

When studying the trends of horse population dynamics, we employed the economic-statistical method, methods of extrapolation, forecasting, and computational-constructive method to substantiate the optimal parameters for horse breeding for the future.

3. Results
Altai occupies an important place in the territorial distribution of horse breeding in Russia. The region is represented by two subjects – the Altai Krai and the Altai Republic. In the pre-reform period (1990), the number of horses in Altai was 220.8 thousand heads (149.3 thousand (65.8%) in the Altai Krai and 77.5 thousand (34.2%) in the Altai Republic).

From 1991 to 2018, the number of horses in Altai decreased from 226.8 to 161.3 thousand heads (28%). The number of horses in the Altai Krai decreased from 149.3 to 56.9 thousand heads (2.6 times). The was caused by the fact that meat and dairy cattle breeding, meat and wool sheep breeding, goat breeding, and commercial grain production were quite developed in the primary natural-climatic zones of the region before the reforms. Horses were used to service these agricultural manufacturing areas.

During the transition to the market economy, these areas were minimized. The number of cattle decreased from 2,043.0 to 725.5 thousand heads (2.8 times), sheep and goats from 1,593.0 to 229.4 thousand heads (almost seven times). This caused a decrease in the population of horses. The development of horse meat herd breeding in some regions only partially ameliorated the decrease in horse stock [6].

Quite the opposite tendencies during the period of market transformation occurred in horse breeding of the Altai Republic. The number of horses in 1991–2018 increased from 77.5 to 104.4 thousand heads (34.7%). Horse population was in the first place among the subjects of the Federal Districts, and on the third place in the country, after Yakutia and Bashkortostan.

The bulk of Altai horses are privately owned by the population, peasant (farmer) households, and officially registered individual entrepreneurs (table 1).

Table 1. The distribution of the number of horses in Altai by the main category of owners, thousand heads as of January 1, 2019.

| Farm category          | Altai, total | Altai Krai | Altai Republic |
|------------------------|--------------|------------|----------------|
|                        | thousand heads | % of total | thousand heads | % of total | thousand heads | % of total |
| agricultural organizations | 34.2         | 21.2       | 19.6          | 34.5       | 14.6          | 14.0       |
| households              | 65.8         | 40.8       | 25.8          | 45.3       | 40.0          | 38.3       |
| PFH* and IE**           | 61.3         | 38.0       | 11.5          | 20.2       | 49.8          | 47.7       |
| Total                   | 161.3        | 100.0      | 56.9          | 100.0      | 104.4         | 100.0      |

* PFH – peasant (farming) households;
** IE – individual entrepreneurs.

Table 1 indicates that 65.8 thousand heads (40.8%) in Altai are owned by private households, 61.3 thousand heads (38%) by peasant farms and individual entrepreneurs, and 34.2 thousand heads (21.2%)
by agricultural organizations.

At the same time in the Altai Krai, public enterprises own the most horses. Agricultural organizations have 34.5% of the livestock. In the Altai Republic, this figure is only 14%.

The main areas of economic use of horses in the region are meat, work-use, tribal, sports, and leisure. The distribution of the modern horse population is shown in Table 2.

**Table 2.** The number of horses by the direction of their use, thousand heads as of January 1, 2019.

| Directions for the use of horses | Altai, total | Altai Krai | Altai Republic |
|---------------------------------|--------------|------------|----------------|
|                                 | thousand     | % to total | thousand       | % to total | thousand      | % to total |
| Work-use                        | 42.5         | 26.4       | 22.3           | 39.2       | 20.2          | 19.3       |
| Meat, including:                |              |            |                |            |               |            |
| agricultural organizations      | 112.6        | 69.8       | 31.9           | 56.1       | 80.7          | 77.3       |
| PFH and IE population (calculation)* | 23.1       | 14.3       | 9.9            | 17.4       | 13.2          | 12.6       |
| Tribal                          | 32.9         | 20.4       | 12.9           | 22.7       | 20.0          | 19.2       |
| Sports and leisure              | 0.5          | 0.3        | 0.3            | 0.5        | 0.2           | 0.2        |
| Total                           | 161.3        | 100.0      | 56.9           | 100.0      | 104.4         | 100.0      |

*Note:* in the calculations, it is assumed that half of the number of horses in the population is attributed to meat horse breeding, the other half to work-use—source: Compiled by the authors.

Table 2 shows that meat horse breeding is in the first place by horse stock – 112.6 thousand heads (69.8%). Meat horse breeding is more developed in the Altai Republic, with 80.7 thousand heads (77.3%). In the Altai Krai, horse meat industry is also the most prevalent – 31.9 thousand heads (56.1%).

In 2007, a separate statistical record was introduced for the livestock of meat herd horses in agricultural organizations and peasant farms. Since this period, horse stock in them has been steadily increasing: 2008 – 39.3, 2010 – 58.2, and 2019 – 79.7 thousand heads. The high growth rates of livestock are caused by several factors.

First of all, horse meat is a valuable nutritious product. It is not inferior to other types of meat in terms of nutritional and biological properties [10].

Some nationalities in Russia, Asia, and Western Europe traditionally consume horse meat and its subproducts. World horse meat production is 750 thousand tons per year. Recently, it has been at a relatively stable level [1].

An essential factor in the expanded development of meat herd horse breeding is the economic efficiency. Horses can use natural pastures that are unsuitable for other livestock types. Thus, in the Altai Republic, there are more than 1 million hectares of underutilized forage lands located on steep mountain slopes and in remote forests, which can be successfully allotted for grazing horses [8]. In the Altai Krai, out of 11 million hectares of agricultural land, 7.0 million hectares (63.6%) are arable land, and 4.2 million are (36.4%) pastures and hayfields [2]. Additionally, significant areas of pasture land in the Altai were freed because the number of cattle, sheep, and goats reduced. These lands can also be used to develop herd horse breeding.

An essential factor in the development of meat herd horse breeding is its high economic efficiency compared with other pasture animal husbandry branches. Table 3 shows the leading economic indicators of marketable meat of various types in CJSC “Novy Put”, located in the Shebalinsky District of the Altai Republic.

Table 3 shows that horse meat on the farm was the cheapest and most profitable. The inclusion of the industry in the national project “Development of the Agro-Industrial Complex” [4] with federal subsidies had a significant positive impact on the expanded development of meat horse breeding.

Tribal horse breeding in Altai is represented by three horse farms and five tribal breeders of the Novoaltai breed with a broodstock of 2,260 mares. To preserve the tribal core of the local breed, two
gene pool farms with a livestock of 459 mares are functioning. There are also three breeding enterprises for breeding heavy-duty horses (two of the Orlov trotting breed with 77 mares and one of the Russian Heavy-Draft breeds with 38 mares).

Table 3. Financial results from the sale of different types of meat (on average for 2007–2009).

| Indicator                      | Types of meat |
|--------------------------------|---------------|
| Per 100kg of sold meat in live weight, thousand rubles: | cattle | sheep | horses |
| costs                          | 5.0           | 2.2   | 1.9    |
| revenue                        | 2.8           | 2.6   | 3.6    |
| profit (- loss)                | -2.2          | 0.4   | 1.8    |
| profitability, %               | -             | 18.2  | 100.0  |

Source: Compiled by the authors.

We substantiated the main parameters of Altai horse breeding development, basing on the main trends that were identified as a result of the analysis. We established that the Altai region would continue further development of meat herd horse breeding and its formation as a specialized commercial meat industry.

The calculations predict that the total meat horse stock will increase by 2.4% of the current amount per year. This growth was derived from the average actual growth rate in the country.

The work-use and tribal horse breeding are to remain at the current level. It is expected that the development of equestrian tourism in the region will lead to an increase in the two-fold increase in the number of sports and leisure horses.

The estimates of horse stock by the end of 2025 are shown in table 4.

Table 4. Estimated horse stock by different areas of horse use by the end of 2025, thousand heads.

| Directions for use                  | Altai, total | Altai Krai | Altai Republic |
|-------------------------------------|--------------|------------|----------------|
| Work-use                            | 42.8         | 22.3       | 20.5           |
| Meat herd, including:               |              |            |                |
| agricultural organizations, peasant farms, and individual entrepreneurs | 126.8        | 35.3       | 91.5           |
| population                          | 93.9         | 22.4       | 71.5           |
| Tribal                              | 32.9         | 12.9       | 20.0           |
| Sports and leisure                  | 6.0          | 2.2        | 3.8            |
| Total                               | 176.6        | 60.3       | 116.3          |

Source: Compiled by the authors.

Table 4 shows that the estimated (predicted) number of horses in Altai in 2025 should amount to 176.6 thousand heads, including 126.8 thousand herd horses (71.8%).

We also substantiated a rational breed structure of horses in meat horse breeding. The preservation of local aboriginal breeds is essential to the gene pool and economics of the industry. Thus, the number of Altai breeds in commercial horse breeding is estimated at 5.9 thousand heads [12, 11].

The main direction of rationalizing the breed structure is the maximum increase in the indicated perspective of purebred and cross-breed Novoaltaisk horses, marked with high meat productivity and unique adaptive qualities [9]. They are significantly superior to analogs of other breed types, including heavy draft crosses, in terms of meat productivity. The live weight of a one-and-a-half-year-old Novoaltaiskaya young horse raised with year-round grazing is 380–400 kg, close to the weight of a specialized beef cattle with final intensive feeding.
Adult Novoaltaiskaya mares in live weight surpass the local Altai ones by 137.6 kg (32.8%), the improved Altai mares with no noticeable signs of the improving breed by 38.0 kg (9.1%), and the crossbreeds with trotting and riding breeds by 83.8 kg (20%) [2].

We estimate that the main stock of meat herd horses by 2025 will be represented by the Novoaltaisk breed and its crossbreeds.

The producing composition of the Novoaltaiskaya breed will allow us to have 9 thousand purebred Novoaltaiskaya horses on commercial farms in Altai (including 4.3 thousand mares) by 2025.

The rest of the breeding stock of meat herd horses (37.9 thousand heads) in the public sector (agricultural organizations, peasant farms, and individual entrepreneurs) are planned to be used in crossing with purebred stallions of the Novoaltaiskaya breed. To create such an array of hybrids, about 2 thousand Novoaltaiskaya stallions must be supplied to commercial farms.

Based on the projected number of horses of different breeds and the estimated turnover of herds, we determined the volumes of meat and horse meat production in the herd horse breeding (table 5).

Table 5. The distribution of herd horses by breed and meat production, projected by the end of 2025.

| Breeds and groups of crosses | Breeding methods | Number of horses, thousand heads | Meat production, thousand centers |
|-----------------------------|------------------|---------------------------------|----------------------------------|
|                             | Total            | incl. mares                      | for one structural horse, kg     |
| Agricultural organizations, peasant (farm) households, and individual entrepreneurs |                |                                 |                                  |
| Altai meat                  | purebred         | 5.9                              | 2.8                              | 98.5                             | 5.8                              |
| Novoaltaiskaya              | purebred         | 9.0                              | 4.3                              | 130.7                            | 11.8                             |
| Hybrid with Novoaltaiskaya  | industrial and absorption crossbreeding | 79.0                             | 37.9                             | 118.5                            | 93.6                             |
| Total                       | -                | 93.9                             | 45.0                             | 118.4                            | 111.2                            |

| Population                  | Average breeding crossing |                                |                                  |
|-----------------------------|---------------------------|---------------------------------|----------------------------------|
|                             | Total                     | 126.8                           | 60.2                             | 114.5                            | 145.2                            |

Source: Compiled by the authors.

The data in table 5 indicates that at the end of the project period, the production of horse meat in the Altai herd horse breeding will amount to 14.5 thousand tons in live weight or 8.1 thousand tons of cut meat.

The estimated production of meat from culled adult horses in work-use, tribal, and sports horse breeding will be about 3.6 thousand tons in live weight, or 2.0 thousand tons in cut meat.

Therefore, the total production of marketable horse meat in Altai in 2025 will amount to 10.1 thousand tons. The projected volume of horse meat production will ensure the satisfaction of the regional needs. Creating a meat processing base will allow significant volumes of frozen meat and semi-finished products to be exported — mainly to China and Japan.

4. Discussion

In our opinion, the main direction of increasing the efficiency of meat horse breeding, currently and in the future, is the creation of intra-industry divisions contributing to a significant increase in the marketability of the industry: enterprises for purchasing live horses, slaughtering, processing, and sale of horse meat.
5. Conclusion
Horse resources and the genetic potential of horse breeding in the Altai region are of great importance to the horse breeding industry in Siberia and Russia. By the end of 2025, the number of horses in all categories of farms in the Altai region will increase from 161.3 to 176.6 thousand heads (9.5%), mainly due to the development of meat horse breeding – from 112.6 to 126.8 thousand heads (12.6%).

Orienting the breed structure towards the maximum growth of livestock and the proportion of purebred and crossbred Novoaltaiskaya horses will ensure the production of about 18.1 thousand tons of live weight, if one were to take into account the culled horses from other horse-breeding industries, or about 10 thousand tons of cut meat.

Creating a modern base for frozen horse meat and semi-finished products will create a stable and efficient domestic market and provide about 4–5 thousand tons of select high-quality meat products for export.

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