

ANNOTATION

of the dissertation work of Khiyassov Madiyar on the topic “Assessment of conditions and study of methods of rational use of pastures”, submitted for the degree of Doctor of Philosophy (PhD) in the educational program 8D08100 - "Agronomy"

Relevance of the research topic.

In the Republic of Kazakhstan, the resolution of issues related to forage production is critically dependent on effective regulation of public relations concerning the rational use and improvement of pastures and their infrastructure, as well as the prevention of pasture degradation processes. Kazakhstan ranks fifth in the world in terms of pasture area, with pastures covering approximately 70 percent of the country's territory. However, this vast land resource is currently underutilized, facing various threats, despite being a fundamental basis for the development of livestock farming both at present and in the foreseeable future.

In this context, the research places significant emphasis on studying the effects of different grazing management practices on forage productivity, phytocenotic structure, and indicators of soil cover in pasture ecosystems.

Alongside other measures aimed at increasing productivity and preserving soil quality, the use of biological agents and bio-organic fertilizers plays an important role in ensuring the sustainable and rational use of pasture ecosystems.

In this regard, the research pays particular attention to studying the effects of the organo-mineral humic fertilizer “Tumat” on the yield, forage capacity, and characteristics of the vegetation and soil cover of pastures in the dry steppe zone of West Kazakhstan Region, with the aim of contributing to the region's food security.

The conducted studies, based on comprehensive monitoring activities, made it possible to assess the current state of pastures and obtain important fundamental and applied scientific results. These findings characterize the response of vegetation and soil cover in pasture lands to various grazing management strategies and to the application of the organo-mineral humic fertilizer “Tumat.” On this basis, a scientifically grounded and effective set of recommendations was developed for improving the productivity and rational use of pasturelands in West Kazakhstan.

The purpose of the thesis research.

Based on monitoring, to assess the current state and develop methods for increasing productivity and rational use of pastures in West Kazakhstan region.

Research objectives.

1. To assess the current state of pasture lands;
2. To study the impact of pasture use methods in the semi-desert zone on the indicators of their vegetation and soil cover;
3. To study the impact of the productivity improvement method using organo-mineral humic fertilizer "Tumat" on the vegetation and soil indicators of pastures in the dry steppe zone;
4. To conduct an analysis of the feed capacity of pastures depending on the methods of their rational use;

5. To provide an economic assessment of the methods of rational use of pasture lands.

Research methods.

To achieve the set goals and objectives, field research was conducted during the period 2021-2023 in accordance with the established methodology.

The research activities included the following components: collection and synthesis of archival and literature sources; fieldwork; laboratory analysis; and the desk-based processing of collected data.

During 2021-2023, field experiments were carried out on the pastures of the "Miras" farm located in Bokeyordinsky District, within the semi-desert zone of West Kazakhstan Region, to study various pasture utilization methods.

The research objects in the semi-desert zone were plain pastures classified as *Artemisia-Stipa-Festuca* communities on light chestnut soils.

Field experiments investigating the effects of the organo-mineral humic fertilizer "Tumat" were conducted from 2021 to 2023 on pastures within the dry steppe zone of West Kazakhstan Region, specifically on the territory of the "Daukara" farm in Bayterek District.

The area of a single plot was 0.50 hectares, including buffer zones, with a threefold replication. The plots were arranged systematically.

The application rate of the preparation was 1 L/ha, with a working solution rate of 200 L/ha. Treatments were carried out using an OPSH-22-2500 sprayer at two time intervals according to the experimental design: once in spring, and twice - once in spring and once in summer.

The research methodology included an assessment of the current state of pasture vegetation in West Kazakhstan Region. For this purpose, regular monitoring observations were conducted using standardized methods and techniques across the monitoring network.

Soil degradation levels were determined based on specific indicators, in accordance with the Order of the Ministry of Agriculture of the Republic of Kazakhstan No. 185 dated April 27, 2017.

Agrochemical analyses of soil samples were performed at an accredited laboratory of Zhangir Khan West Kazakhstan Agrarian-Technical University.

Pasture yield data were statistically processed using analysis of variance.

The economic evaluation was conducted based on prevailing market prices during the study period.

The main provisions submitted for defense (proven scientific hypotheses and other conclusions that constitute new knowledge).

– Current state of vegetation and soil of pastures of the semi-desert zone of West Kazakhstan region depending on the method of their use;

– Effect of organo-mineral humic fertilizer "Tumat" on the indicators of vegetation and soil cover of pastures of the dry steppe zone of West Kazakhstan region;

– Indicators of pasture feed capacity depending on the methods of their use;

– Economic efficiency of methods of rational use of pastures.

Description of the main results of the study.

Based on the conducted research on methods for the rational use of pastures in West Kazakhstan Region, the following results were obtained:

The quantitative and qualitative characteristics of pastures in the semi-desert zone of West Kazakhstan Region depend significantly on the method of their utilization. During the summer season, the highest quality pasture composition was observed on pastures managed under a rotational grazing system. Over the three-year study period, rotationally grazed pastures demonstrated an average total projective cover of 75%, with highly valuable grass species accounting for 60.67% of the phytomass. In these areas, *Artemisia* species comprised 12%, while forbs made up 14.67%. In contrast, pastures subjected to intensive grazing showed an increased proportion of *Artemisia*, reaching 17.00%, and a higher proportion of forbs at 22.33% in the phytocenosis composition. In terms of productivity, during the summer season, the average herbage yield on intensively grazed pastures was 3.89 c/ha, which was lower compared to pastures managed under rotational and seasonal grazing systems - yielding 10.95 and 8.07 c/ha, respectively.

Intensive grazing negatively impacts the quantitative and qualitative state of pasture vegetation and leads to a persistent forage deficit. The highest levels of crude protein, crude fat, calcium, potassium, phosphorus, and carotene were recorded on pastures managed with rotational grazing.

Grazing methods also influence the properties of light chestnut soils in the semi-desert pastures of West Kazakhstan Region, including humus content and available phosphorus. Intensive grazing is associated with higher soil bulk density, increased exchangeable sodium content, and the lowest indicators of soil structural stability. In contrast, rotational grazing results in less pronounced soil compaction and structural degradation.

The implementation of rotational grazing increased the pasture carrying capacity to 0.29 head/ha, compared to just 0.09 head/ha under intensive grazing.

Rotational grazing of livestock on natural pastures was found to be more economically efficient than intensive grazing. Under the rotational grazing system, the additional income per livestock head amounted to 35,870 tenge.

Treatment of pasture vegetation with the organo-mineral humic fertilizer “Tumat” had a positive effect on the indicators of pasture vegetation cover. The yield of pasture phytocenoses increased by 19.05% during the first grazing and by 11.11% during the second grazing following a single application. When the fertilizer was applied twice- once in spring and once in summer - the average pasture yield increased by 22.22%.

In addition to improving yield, the “Tumat” application also positively influenced the forage mass quality. The highest crude protein content, ranging from 7.24% to 7.31%, was recorded in samples of pasture plants treated with the organo-mineral humic fertilizer “Tumat.” In comparison, the crude protein content in the control samples was significantly lower - by 3.19-3.26% - amounting to only 4.05%. Plant samples collected from pastures treated in the spring and in the spring-summer periods with “Tumat” showed superior quality composition compared to the untreated control variant.

The application of the organo-mineral humic fertilizer “Tumat” has a positive effect on the forage capacity of pastures in the dry steppe zone. With a single application of the biofertilizer, and a green mass yield of 10.80 c/ha over the grazing season, the pasture carrying capacity increased to 0.12 head/ha, which is 0.02 head/ha higher than the control. With two applications of “Tumat,” in spring and summer, and a seasonal herbage yield of 11.20 c/ha, the pasture carrying capacity also reached 0.12 head/ha.

The use of “Tumat” also positively contributes to the restoration processes of soil cover in pasture phytocenoses. Due to the application of the biofertilizer, nitrate nitrogen content in dark chestnut soils increased by 3.50-4.20%, available phosphorus by 2.63-3.29%, soil bulk density decreased by 0.01 g/cm³, and soil structure improved by 0.18-0.32%.

The proposed scientifically grounded method of increasing pasture productivity through double application of the organo-mineral humic fertilizer “Tumat” has proven to be economically effective. When grazing livestock on pastures treated with the biofertilizer at two time points, the additional income per head of livestock, compared to grazing on degraded control pastures, amounted to 36,210 tenge.

Justification of the novelty and importance of the obtained results.

For the first time under the conditions of the semi-desert zone of West Kazakhstan Region, the impact of different pasture utilization methods on vegetation and soil cover indicators has been studied;

For the first time under the conditions of the dry steppe zone of West Kazakhstan Region, the effect of a productivity enhancement method involving the application of the organo-mineral humic fertilizer “Tumat” on pasture vegetation and soil characteristics has been investigated;

For the first time in West Kazakhstan Region, effective practices for the rational use of pasture ecosystems have been proposed for agricultural producers, based on optimal grazing strategies and the application of the organo-mineral humic fertilizer “Tumat.”

The research results have been implemented on a 50-hectare area of the “Miras” farm in Saralzhynsky rural district of Bokeyordinsky District, and on a 10-hectare area of the “Daukara” farm in Trekinsky rural district of Baytereksky District, both located in the West Kazakhstan Region.

Compliance with scientific development directions or state programs.

The research was conducted within the framework of the Scientific and Technical Program of the Center for Agricultural Development BR10764915 “Development of new technologies for the restoration and rational use of pastures (use of pasture resources)” and the Scientific and Technical Program of the Center for Agricultural Development BR10764865 “Scientific and technological support for the preservation and reproduction of the fertility of agricultural lands” under agreements concluded with the Ministry of Agriculture of the Republic of Kazakhstan.

Description of the PhD student's contribution to the preparation of each publication.

During the execution of the thesis, the PhD student was distinguished by

great responsibility and personal contribution to the development of the program and methodology of the research, laying and conducting experiments. He completed the tasks of the research work with great interest. With the correct use of specific methods of observation, accounting, analysis in solving the tasks set, the intended results were achieved. The author personally participated in experimental studies, mastered the methodology of laying out field experiments. All results and conclusions presented in the dissertation were obtained and formulated with the direct participation of the applicant in accordance with the results of the study conducted.

The author actively participated in the discussion and publication of the research results in scientific journals, as well as in the preparation and presentation of abstracts for international scientific and practical conferences. As a result of the scientific research, 20 scientific works have been published, including 8 articles in scientific journals recommended by the Committee for Control in the Field of Education and Science of the Ministry of Science and Higher Education of the Republic of Kazakhstan, 3 articles in scientific journals indexed in the Scopus database, 5 articles in the proceedings of international scientific and practical conferences, 1 methodological recommendation, and 3 utility model patents of the Republic of Kazakhstan.

Volume and structure of the thesis.

The thesis, consisting of 166 pages, includes an introduction, literature review, research results, conclusion, and recommendations for practical application. The work contains 19 figures, 27 tables, and 7 appendices. The list of references includes 166 sources, 94 of which are from foreign authors.