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Changes in the Quality of Vegetation Cover and Soil of Pastures in Semi-Deserts of West Kazakhstan, Depending on the Grazing Methods

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ABSTRACT

The purpose of this paper was to assess the impact of grazing methods on the indicators of vegetation and soil cover of pastures located in the semi-desert zone in the West of Kazakhstan. The experiment was carried out on 3 pastures with different grazing methods, and a reference plot with no grazing served as a control variant. Transects measuring 100*50 m were laid on pastures, where all regime observations of herbage indicators were carried out. Soil samples were taken in layers of 0–10, 10–20, and 20–30 cm with 3-fold repetition. The lowest indicators of yield (0.38 t/ha), projective coverage (45%), species composition (12 pieces), and herbage height (22 cm) were established on pastures with intensive grazing. Intensive grazing also reduced the quality of the soil, where a low content (0.83 percent) and reserves of humus (34.19 t/ha) and phosphorus (0.65 mg/100g) were found, and the soil compacted to 1.38 g/cm^3, its structure decreased to 53.15%, the soil degraded to the 3rd degree and became moderately solonetzic. High values of vegetation and soil cover indicators were obtained on pastures with rotational grazing. In the rotational grazing variant, the yield difference compared to the control variant amounted to 0.41 t/ha, and the yield of feed units (0.07 t/ha), digestible protein (0.011 t/ha), and exchange energy (1.08 GJ/ha) had increased. A higher content of available phosphorus (0.95 mg/100g of soil), agronomically valuable structural aggregates (67.55%), a looser density (1.24 g/cm^3), and weak salinity were found in the soil cover of rotational grazing pastures.

Keywords: grazing methods, plant community, yield, feed value, soil cover.

INTRODUCTION

Pastures, one of the largest terrestrial ecosystems in the world, are crucial for wildlife habitat [Galli et al., 2012], livestock feed [Odrizola et al., 2014], and the lives of nearly 800 million people worldwide [FAOSTAT, 2015]. The ecosystems of Kazakhstan's pasture lands face significant challenges due to the increased demand for food from an ever-growing population and the obvious global climate change. Currently, there are about 188 million hectares of pastures in Kazakhstan, which occupy 70% of the total land area [Nasiyev et al., 2015]. In Kazakhstan, according to experts, about 37 million hectares of pastures are used irrationally [Nasiyev et al., 2016], and the area of degraded pasture lands amounts to more than 48 million hectares (25.5% of the total pasture area) [Nasiyev et al., 2018]. As a result of the over-saturation of cattle and haphazard grazing, 27 million hectares of pastures within a radius of 5–6 kilometers from settlements have been degraded. For the same reason, the pasture load has significantly increased, the yield and feed intensity of pasture lands have decreased, desertification processes are intensifying in vast territories, and the veterinary situation has become more complicated, which has led to an increase in the disease incidence of livestock [Nasiyev et al., 2015]. Degraded pastures are characterized by a decrease in vegetation cover, deterioration of the structure and functions of the soil, and are subject to erosion and desertification [Li et al., 2004; Liu et al., 2004]. As in many other arid regions of the world, pasture lands in Kazakhstan play a key role as a source of food production and are very important in the local economy. In this regard, as part of the protection and organization of the strategy for the rational use of pasture ecosystems in Kazakhstan, the Law on Pastures was adopted and the norms of this law allow the use of various effective methods of grazing, including pasture turnover and seasonal use of pastures [Parliament of the Republic of Kazakhstan, 2017] Various methods of grazing farm animals can be used to increase production efficiency on permanently grazed pastures [Cuchillo et al., 2018]. Management techniques such as pasture exclusion and rotational grazing can help restore pasture ecosystems. Uncontrolled grazing seriously affects the biomass of aboveground vegetation, soil organic matter, large soil aggregates, nitrate mineralization, and soil moisture content [Qasim et al., 2017]. The practice of seasonal (only in a certain season) and rotational grazing (pasture turnover, including the dormant season) are pasture management strategies [Howery et al., 2000] that can help reduce the risk associated with the production of livestock on pastures on a smaller scale. Seasonal grazing methods require less labor and require fewer management decisions than intensive grazing methods [Mata-Padrino et al., 2021].

Seasonal postponement of grazing may benefit livestock productivity [Buttolph and Coppock, 2004]. In studies conducted in semi-arid meadows of Makueni County, Kenya, the percentage of vegetation cover was significantly higher in areas with rotational grazing compared to those with permanent grazing. The species richness of plants was highest in areas with rotational grazing (13.4 ± 1.82, 11.9 ± 1.74, and 9.67 ± 2.24) [Rotich, 2018]. Intensive grazing strongly affects the structure, species diversity, and composition of vegetation [Gamoun, 2014].

With seasonal use, pasture areas get the opportunity to rest, which subsequently has a positive effect on the quantitative and qualitative composition of vegetation and soil cover [Nasiyev et al., 2016]. Rest, even for one year, will allow pastures to significantly restore their sparse grass cover [Kleppel, 2020]. In the studies by Yuping Rong, Fei Yuan, and Lei Ma [2014] the elimination of grazing sheep from the desert steppes for 8 years increased vegetation cover and about three times increased the biomass of vegetation, especially the shrubs component, increased the contents of total nitrogen, at a depth of 0–10 cm (110%) and 10–20 cm (60%) and total phosphorus at a depth of 0–10 cm (114%) and 10–20 cm (64%) ($P < 0.05$). In addition, grazing affects the physical properties of the soil and the hydrology of surface waters, which can lead to serious consequences for plant growth in dry climates where water is a scarce resource [Jeddi and Chaieb, 2010].

Pasture rest management is considered a vital strategy for maintaining pasture productivity for human use [Clewell and Aronson, 2006], and reducing grazing pressure can contribute to the natural recovery of degraded drylands [Havstad and Herrick, 2003]. The economic benefit that rested pastures provide is cattle grazing. The benefits offered by rested pastures are also ecological, including biodiversity conservation [Gamoun et al., 2015].

Competent management of pasture ecosystems through the organization of optimal grazing methods contributes to the achievement of three results of not only national but also global significance arising from international conventions on the environment, on the cessation of the spread of deserts (Convention to Combat Desertification), on the conservation of biodiversity, through the restoration and expansion of habitat (Convention on the Conservation of Biodiversity) and on carbon uptake (Convention on Climate Change) [Shamsutdinov et al., 2013].

The purpose of the study was to identify changes in the indicators of vegetation and soil cover of pastures under the influence of different methods of farm animal grazing, for the rational management of pasture resources in the semi-desert zone of West Kazakhstan.

The idea and data of the study serve as a prerequisite for the development of protective measures for the rational use of pasture ecosystems of Kazakhstan, as well as other regions and countries.

MATERIALS AND METHODS

Description of the study sites

The study was conducted in 2018–2021 at the Zhangir Khan West Kazakhstan Agrarian and Technical University (Republic of Kazakhstan) on the initiative of the Ministry of Agriculture in the semi-desert zone of West Kazakhstan (Figure 1).

The study was carried out on 3 pastures of the Miras farm with different grazing methods specified in the experimental scheme (Table 1).

The objects of the study are pastures of the semi-desert zone on light chestnut soils with a predominance of *Artemisia lercheana, Stipa capillata, Festuca valesiaca*.

Agro-climatic conditions of the semi-desert zone

The semi-desert zone of West Kazakhstan is characterized by a sharply continental climate. The main source of moisture in the zone is precipitation, the annual amount of which equals 190–220 mm.

The amount of precipitation falling in spring is not constant. Sometimes in spring, there is 3–4 times more precipitation than usual, and in dry years there is practically no precipitation. The summer months are distinguished by hot, dry, and sunny weather.

In June, the daytime temperature is about 24–28 degrees, in July it equals 27–31 degrees, and on August 25–28 degrees. The temperature limit reaches 41–42 degrees. In this zone, summer precipitation is very unstable. its amount varies dramatically over the years, often no more than 5 mm of precipitation falls for two or three months in a row.

The pasture period is within 180–200 days per year. Cattle grazing on pastures is carried out in the spring, summer, and autumn seasons. In winter, cattle are driven into barnyards using harvested feed (hay, fodder).

The duration of the period with a stable snow cover is 80–105 days, the average of the greatest decadal snow cover heights is 10–15 cm, and water reserves in the snow equal 40–50 mm. The snow cover stays for 1.5–2 months at a low altitude.

Study of the vegetation cover of pastures

To study the plant community on pastures transects measuring 100×50 m were laid, where all routine observations were carried out: the study of species composition, projective coverage, height, and yield of pasture herbage.

Soil sampling

The soil of pasture areas is light chestnut (calcic kastanozems). To determine the effects of grazing on soil indicators, samples were selected for all variants of the experiment, including the control variant in layers of 0–10 cm, 10–20 cm, and 20–30 cm. The repeatability of the selection was 3-fold.

In studies based on criteria approved by the Order of the Minister of Agriculture of the Republic of Kazakhstan No. 185 dated April 27, 2017, the degree of degradation of the soil cover was established. The criteria include:

1. Reduction of reserves of humus in the 0–30 cm layer of the figure in the control plot, in percent (%);

Figure 1. Location of the study sites

Table 1. Scheme of the experiment to study the effects of grazing methods on the indicators of vegetation and soil cover of pastures in the semi-desert zone of West Kazakhstan

Grazing method variants	The order of use of pastures	Pasture area, type, and number of livestock
No grazing (control variant)	As a control variant, an area with untouched vegetation and soil cover located in a semi-desert zone outside the territories of the farm was selected (reference plot)	No grazing
Rotational grazing	Pastures are used in the pasture turnover system in the spring-summer-autumn seasons, used 1 time per year in 1 season, and the remaining 3 seasons and once in 4 years all seasons are used for rest	560 ha, 80 heads of cattle
Seasonal grazing	Pastures are used annually only in the summer season with rest in the spring and autumn seasons	560 ha, 80 heads of cattle
Intensive grazing	Pastures are used annually without rest in all seasons, i.e. haphazardly	560 ha, 80 heads of cattle

2. a decrease in the content of mobile phosphorus from the indicator in the control plot, in percent (%);
3. the increase in the content of exchangeable sodium (% of the cation-exchange capacity);
4. an increase in soil density, g/cm^3 in the layer of 0–30 cm from the indicator in the control plot, in percent (%);
5. soil structure (the content of agronomically valuable aggregates), % [Minister of Agriculture of the Republic of Kazakhstan, 2017]. In this regard, in studies in the soil cover of pasture lands, we studied the aforementioned indicators.

Physical and chemical soil analyses

Determination of soil density was performed by the method of cylinders according to N.A. Kachinsky. To determine the density of the soil in the field, samples from soil horizons at 0–10, 10–20, 20–30 cm were taken with a drill cylinder with a volume of about 500 cm^3. At the same time, soil samples were collected in weighing bottles to determine humidity. In the laboratory period, the soil was dried at 105°C to a constant weight. Knowing the mass of a dried-soil weighing bottle and the mass of an empty weighing bottle, the mass of air-dry soil was found. Then, by dividing the mass of dry soil by its volume (the volume of the ring), we determined the density of the soil [Gabdulov et al., 2018].

The method of dry sieving to determine the structure of the soil

To determine the content of agronomically valuable aggregates in the soil under laboratory conditions, soil samples were subjected to structural state analysis using sieves of different sizes. The soil structure was judged by the content of lumpy granular water-stable aggregates ranging in size from 10 to 0.25 mm [Gabdulov et al., 2018].

In laboratory conditions, the content of humus, mobile phosphorus, and exchangeable sodium in the soil was determined by analyzing soil samples [Gabdulov et al., 2018].

The content of humus in the soil was determined by the method developed by I.V. Tyurin, which is based on the oxidation of the organic matter of the soil with chromic acid until the formation of carbon dioxide. As an oxidizer, we used a solution of $K_2Cr_2O_7$ in sulfuric acid. The oxidation reaction proceeds according to the following equations:

$$2K_2Cr_2O_7 + 8H_2SO_4 =$$
$$= 2K_2SO_4 + 2Cr_2(SO_4)_3 + 8H_2O + 3O_2$$

$$3C + 3O_2 = 3CO_2$$

Based on the data obtained on the humus content and soil density, a humus reserve for a layer of 0–30 cm was established.

Mobile phosphorus compounds were determined by the photometric method developed by I. Machigin, which is based on the extraction of mobile phosphorus compounds from the soil with a solution of ammonium carbonate $(NH4)_2\ CO_3$ concentrations of 10 g/dm^3 with a ratio of soil to a solution of 1:20 and subsequent determination of phosphorus in the form of a blue phosphorus-molybdenum complex on a photoelectrocolorimeter.

The content of exchangeable sodium in the soil was established by the photometric method, by removing exchangeable and soluble sodium with a solution of ammonium acetate (NH_4CH_3COO) = 1 mol/dm with a pH of 6.7 to 7.0

and a concentration of 1 mol/dm^3, with the mass ratio of soil samples and the volume of solution equaling 1:20 and a subsequent determination of sodium in the extract on the flame photometer. At the same time, soluble sodium was determined in an aqueous extract and the exchangeable sodium was calculated by the difference. According to the content of exchangeable sodium in the cation exchange capacity, the degree of salinity of the soil was determined.

The degree of salinity of soils is calculated by the formula $C_c = \frac{Na \cdot 100}{EKO}$, where C_c is the degree of salinity from the absorption capacity, %; Na is the content of exchangeable sodium, c.mol/kg-1; 100 is the conversion factor as a percentage; and CEC is the cation exchange capacity, c.mol/kg-1 [Gabdulov et al., 2018].

Data analysis

The productivity indicators of the plant community and soil were statistically processed by the method of one-factor analysis of variance, using the SAS® OnDemand for Academics program. The chart of quality indicators for grazing variants was built using MS Excel software.

RESULTS

As the data of the study showed, biometric indicators of pasture lands of the semi-desert zone depended on the methods of grazing farm animals.

In the summer season, on pastures with seasonal and rotational grazing, the projective coverage was at the level of 75–85%, while on pastures with intensive grazing, the projective vegetation coverage decreased to 45%. When using pastures according to the principle of seasonal and rotational grazing, the height of the herbage reached 28–35 cm. In the studies, the lowest height (22 cm) of the herbage was found on pastures with intensive grazing. In studies on a reference plot in the absence of grazing, the projective coverage of pastures at a herbage stand height of 51 cm was 95% (Table 2).

Pasture lands also differed in species composition. On the pasture with intensive grazing, the number of species was at a minimum level (12), where mainly little-eaten and non-important plants *Artemisia lerchiana*, *Artemisia austriaca*, *Ceratocarpus arenarius*, *Chenopodium elbum*, *Poa bulbosa*, *Tanacetum achilleifolium*, *Lipidium perfoliatum*, *Gypsophila paniculata*, as well as weeds and harmful plants such as *Tláspi arvénse*, *Ritillária*, *Alyssum Turkestanicum*, *Galium aparine*, *were abundantly present.* As a result of haphazard grazing, the most valuable plants such as *Kochia prostrata*, *Festuca valesiaca*, *Leymus ramosus*, *Koeleria cristata*, *Agropyron desertorum*, *fell out of the herbage.* Plant indicators of digression *Alhagi pseudalhagi*, *Euphorbia*, *Anabasis aphylla*, *Xanthium strumarium*, *Datura*, and modification vegetation such as *Anabasis and Euphorbia*, *were found everywhere.* Observing the state of pastures, one can make a conclusion about digression or degradation.

In the studies, the most high-quality composition of pastures was noted in the pastures of the reference area (with no grazing), and also in the ones with rotational and seasonal grazing. In the herbage of these pastures, in the presence of 14–23 species, an abundance of the most valuable cereal plants in the forage ratio *Agropyron desertorum*, *Stipa capillata*, *Festuca valesiaca*, *Leymus ramosus*, *Koeleria cristata*, and *Kochia prostrata* was established.

According to the study data, the productivity of pasture herbage depends on the methods of farm animal grazing. In the 2018–2021 studies, when using seasonal and rotational grazing, the yield of the green mass of pasture herbage in the summer season equaled 0.63–0.81 t/ha (Table 3). With an increase in the load due to unsystematic grazing, the productivity of pasture cenosis decreased to the level of 0.38 t/ha of green mass.

Table 2. Indicators of vegetation cover of pastures of the semi-desert zone of West Kazakhstan, depending on the methods of grazing, the average for 2018–2021

Grazing method variants	Projective coverage, %	Number of types	Height of the herbage, cm
No grazing (control)	95	23	51
Rotational grazing	85	17	35
Seasonal grazing	75	14	28
Intensive grazing	45	12	22

According to the indicators of the collection of feed units and digestible protein, the productivity of pasture herbage when used for seasonal and rotational grazing equaled, respectively: 0.12; 0.012 and 0.16; 0.017 t/ha. At the same time, the provision of feed units with digestible protein was at the level of 105–115 g.

The lower yield of feed units and digestible protein from 1 ha compared with other experimental variants was observed in the intensive grazing variant (0.06 and 0.003 t/ha). In this variant, the provision of feed units with digestible protein decreased to 58 g.

The output of the exchange energy in the grazing variants was at the level of 0.87–2.26 GJ/ha. In terms of energy value, the use of seasonal and rotational grazing of animals in the pastures of the semi-desert zone occupies an advantageous position. With unsystematic use of pastures, the collection of exchange energy in comparison with the variants of seasonal and rotational grazing was less by 0.81–1.39 GJ/ha or by 48.21–61.50%.

In the studies, the productivity of the control variant (with no grazing) was at the level of 1.22 t/ha of green mass, 0.23 t/ha of feed units, 0.028 t/ha of digestible protein, and 3.34 GJ/ha of exchange energy.

Changes in soil quality

It is known that an increase in the intensity of bleaching negatively affects the properties of the soil. The soils of degraded pastures are characterized by increased density and slightly reduced indicators of structurality. Our study in 2018–2021 showed that the dynamics of soil properties varied depending on the intensity of grazing at the pasture phytocenoses. Changes in the density, structural composition of soils, humus content, mobile phosphorus, and exchangeable sodium were studied on pastures with different grazing methods (Figure 2).

The concentration of humus in the soil (F = 164.88; P < 0.0001), humus reserves in the soil (F = 105.54; P < 0.0001) significantly decreased on pastures with unsystematic intensive grazing compared to the soil of the reference plot (control) (Figure 2a). The decrease in humus content in the soil of pastures with intensive grazing compared to the reference site (control variant) was 0.47% (Figure 2a), and the humus reserves compared to the reference site decreased by 13.59 t/ha or 28.44% (Figure 2b).

In the studies, a significant decrease in the content of available soil phosphorus (F = 99.02; p<0.001) was also found on intensively grazing pastures; a decrease at the level of 0.40 mg/100 g or 38.09% compared to the control variant (no grazing) (Figure 2c).

Continuous intensive grazing significantly increased soil density to 1.38 g/cm^3 or 13.11% (F = 35.21; p < 0.001) compared to the control pasture density (no grazing) (Figure 2d). As a result, the light chestnut soil degraded to the 3rd degree.

Intensive grazing reduces the soil structure. According to the results of dry sieving of selected soil samples, there was a decrease in the contents of agronomically valuable structural aggregates with a size of 10 to 0.25 mm from 75.03% (control soil) to 53.15% (F = 137.06; p < 0.001) (Figure 2e).

The deterioration of agrophysical and agrochemical properties due to intensive grazing contributed to an increase in the content of exchangeable sodium in the composition of light chestnut soils from 1.30 c.mol/kg-1 (control soil) to 1.66 c.mol/kg-1 or by 27.69% (F = 126.17; p < 0.001) (Figure 2f). The process of salinization intensified and the soil moved from the categories of "not solonetzic" to the category of "weakly solonetzic".

Table 3. Indicators of productivity, energy, and protein value of pastures of the semi-desert zone of West Kazakhstan, depending on grazing methods, the average for 2018–2021

Grazing method variants	The yield of green mass, t/ha	The output of feed units, t/ha	Collection of digestible protein, t/ha	The output of the exchange energy, GJ/ha
No grazing (control)	1.22±0.071	0.23±0.035	0.028±0.002	3.34±0.066
Rotational grazing	0.81±0.032	0.16±0.034	0.017±0.004	2.26±0.037
Seasonal grazing	0.63±0.035	0.12±0.028	0.012±0.004	1.68±0.037
Intensive grazing	0.38±0.033	0.06±0.022	0.003±0.002	0.87±0.039
F-test	***	***	***	***

Note: F test of significance: *** – p-level < 0.0001.

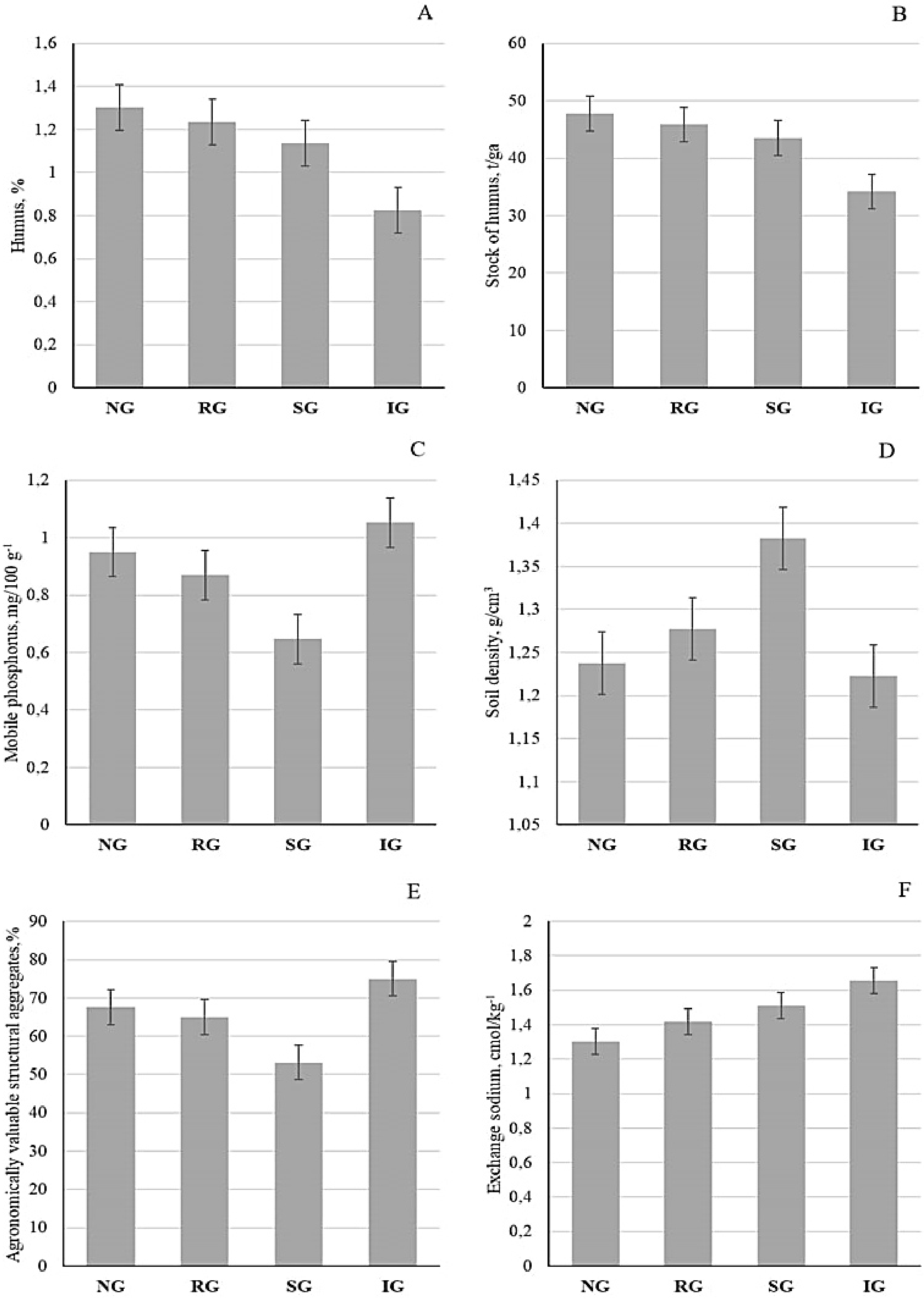

Figure 2. Change in the indicators of the light-chestnut soil under the influence of grazing in the area of semi-desert of West Kazakhstan, 2018–2021 (┬ St. dew.); humus, % (a) humus reserves, t/ha (b); mobile phosphorus, mg/100 g-1 (c); soil density, g/cm3 (d); agronomically valuable structural aggregates, % (e); exchangeable sodium, cmol/kg-1 (f). No grazing: NG, rotational grazing: RG, seasonal grazing: SG, intensive grazing: IG

DISCUSSION

Vegetation indicators

About 37% of the world's dry land area is occupied by pastures, which are a valuable source of nutrients for livestock, an opportunity for plant diversity, and an important habitat for wildlife in general, if managed sustainably [Mata-Padrino et al., 2021]. In studies on pastures with rotational and seasonal use, the projective coverage was at the level of 75–85%, and the exclusion of grazing improved vegetation cover, flora richness, and productivity [Shamsutdinov et al., 2013; Gamoun, 2014].

Grazing has caused serious degradation of vegetation both directly (by animals eating the grass) and indirectly (by trampling) [Kleppel, 2020]. According to the results of our study, the smallest species composition of vegetation in the amount of 20 species with a low height of 22 cm was found on pastures with intensive grazing. Reducing the load on pastures contributes to a change in qualitative indicators, such as the height and species composition of the phytocenosis for the better [Nasiyev et al., 2016]. This hypothesis is also confirmed by our study data. In studies, compared with the intensive grazing variant on pastures with rotational and seasonal grazing, an increase in the number of pasture plant species by 2–4 species was noted. In addition, in the pastures with optimal grazing, there was an increase in the height of pasture herbage by 6–13 cm compared to the intensive grazing variant.

Previous studies in this area had shown that grazing had a wide range of effects on the composition, diversity, and productivity of pasture lands [Nasiyev, 2013; Gamoun, 2014]. In our studies, the yield of phytomass, the yield of feed units, the collection of digestible protein, and the output of the exchange energy of semi-desert pastures depended on the method of agricultural animals grazing. Based on the results of the analysis of variance, significant differences were found between the averages in the groups according to the grazing method at the p-level < 0.0001. Therefore, with a high probability (99%) we can say that the way of agricultural animals' grazing affects the level of pasture productivity.

The highest productivity was established on pastures with the use of rotational grazing, which differed in productivity by the smallest deviation from the control variant. Thus, when using this grazing method, the yield difference compared to the control was 0.41 t/ha, the yield of feed units was 0.07 t/ha, the collection of digestible protein was 0.011 t/ha and the yield of exchange energy was 1.08 GJ/ha, and it can be concluded that this method of grazing is the most environmentally friendly compared to seasonal and unsystematic grazing. In studies, the greatest deviation of productivity parameters from the control variant was noted in the intensive grazing variant.

Soil indicators

Our study showed that livestock grazing significantly reduced the agrophysical and agrochemical indicators of the soil, along with vegetation. This was due to a reduction in vegetation height, cover, and biomass with an increase in grazing intensity [Wachiye et al., 2022].

Studies of the impact of animal trampling on haphazardly used pastures have shown that the harmful effects of animal grazing on volume density and aggregate stability tend to become more serious as the number of animals grazing per unit area increases [Poffenbarger, 2010; Wang et al., 2020]. We found an increase in soil compaction of up to 13.11% with an increase in grazing intensity compared to no grazing [Neff et al., 2005].

Since grazing has a significant impact on several ecosystem services (for example, nutrient retention, water storage, reduction of vegetative mass of a plant community), its reduction can lead to a decrease in soil fertility and, consequently, to land degradation [Mata-Padrino et al., 2021]. In studies, the soil of pastures with intensive grazing was degraded to the 2nd degree in terms of humus reserves, and to 3 degrees in terms of density changes. In addition, as a result of deterioration of agrophysical and agrochemical properties, salinization of light chestnut soils of pastures with intensive grazing was observed. According to our hypotheses, a strong change in soil quality in pastures with unsystematic grazing is the result of the effects of excessive loads by farm animals against the background of arid climate [Nasiyev et al., 2016].

According to the analysis data in the studies, the smallest deviations in soil density (0.02 g/cm^3), humus content (0.0%), and humus reserves (1.94 t/ha) compared to the control variant with no grazing were observed in the rotational grazing variant ($p < 0.001$).

The soil of rotational grazing pastures had a significantly higher available phosphorus content of 0.95 mg/100 g of soil ($p < 0.001$) and agronomically valuable structural aggregates of 67.55% ($p < 0.001$) than the ones with the continuous grazing, as well as a looser density of 1.24 g/cm^3 ($p < 0.001$).

Rotational grazing compared with the control variant (with no grazing) slightly increased the content of exchangeable sodium at the level of 1.42 c.mol/kg-1 ($p < 0.001$) or by 9.23%, and the soil retained its salinity quality (weakly solonetzic).

Rotational grazing is of increasing national and global interest as one of the potential "climate-wise" tools for improving soil health more broadly [Derner et al., 2017].

In studies, seasonal grazing of farm animals only in the summer also reduced soil indicators and, in terms of its effect on the qualitative composition of the soil, occupied an intermediate position between the methods of rotational and unsystematic grazing.

This study showed that high-quality pasture management by regulating grazing could quickly improve pasture lands and provide a feed resource for livestock for future seasons. This, in turn, determines the stability of arid pastures. Sustainable use of natural vegetation and reduction of pasture soil degradation processes are important for ensuring the livelihood of the rural population, ensuring economic and social incomes, and increasing economic productivity [Dembélé et al., 2006].

CONCLUSIONS

As a result of the conducted study, the hypothesis of the negative impact of intensive grazing on the plant community and the soils of pasture ecosystems has been proved. As a result of the increased load, the qualitative indicators of vegetation cover decrease and degradation processes are observed in the soil due to a decrease in the humus reserves and also due to soil compaction, which increases the content of exchangeable sodium and the emergence of salinization signs.

The use of rotational grazing of farm animals is the most favorable way aimed at preserving the indicators of the plant community and the soil of the semi-desert zone of West Kazakhstan.

When using the rotational method, the yield of vegetation cover of semi-desert pastures increases by 0.43 t/ha or more than 2 times with optimal indicators of feed and energy-protein value in comparison with biosystem grazing. The rotational method, in comparison with intensive use of pastures, increases the humus content in the soil by 0.41% and improves the soil structure by 14.4%, also contributing to a decrease in soil density by 11.29%, ensuring an increase in the content of available phosphorus by 46.15% and maintaining a weak degree of salinity.

Studies aimed at organizing measures for soil protection and rational management of pasture ecosystems have prospects and further research in this area will be continued.

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