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Demutation of Arid Pastures Different in Degree of Pasqual Digression in Isolation from Grazing

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Abstract

The article considers the problem of using forage lands in pasture livestock farming in the context of increasing pasqual digression in the southern regions of Russia. The research is aimed at the study of the ability of vegetation cover of natural arid pastures different in degree of degradation to self-recovery. For this purpose, within three years, comparative field studies of the dynamics of yields, species composition, total projective cover (TPC) of pasture phytocenoses on pastures used by animals in grazing and on isolated pasture areas were carried out. The study results have shown the following in all isolators: an increase in TPC of grass stand by 6-39%; an increase in the grass stand productivity 3-5 times, and enrichment of the species composition by 2-7 species in comparison with grazing fields (except for Plot No. 4). On the pasture with a very badly disturbed ecosystem, there was no change in species composition in isolation. Thus, the process of self-recovery of the grass stand on semi-desert natural pastures (with 1-3 points of ecosystem damage) in the arid zone of the south of Russia was recorded from the first year of isolation from grazing with a livestock load of no more than 3.0 a.u./ha.

Keywords: arid pastures, grazing, pasture management.

Introduction

The growing population of the world, especially in cities and industrial centers, provides an increase in demand for livestock products, especially for meat and fats. Therefore, the provision of agricultural animals with pasture fodder lands becomes critical. This is especially true for the arid regions of the world, where half of all grazing livestock is bred. In 1977, in Nairobi, Kenya, during the first United Nations Conference on Desertification it was recognized that the biosphere of Earth is degrading due to human impact on nature, including domestic animals feeding on vegetation and land depletion as a result of its excessive use. According to the UN, soil degradation and potential desertification affect more than 1 billion people and about a third of all agricultural land on the planet. Primarily, this applies to the vast territories of North Africa in the natural zone of Sahel, to South Africa, Central and South Asia, Australia, parts of the Americas, and also Southern Europe. In addition, drought and land degradation contribute to the emergence of interstate conflicts (caused, for example, by the violation by the citizens of a distressed country of the foreign state borders in search of food). Thus, in order to combat desertification effectively, a set of measures in the agricultural, social, economic and political fields is required. In this regard, we directed our research to find a way to use arid pastures without causing damage to vegetation and preserving its biodiversity.

Literature Review

The main functional core of aboveground ecosystems is plant communities that create more than 90% of their biomass. Grazing of domestic animals and stripping with wild ungulates is a factor that influences the formation of pasture grass stand [1]. In the areas where the cattle breeding is based on natural grazing, accelerated erosion processes and changes in vegetation cover are observed in the directions undesirable for economic activities [2]. Thus, the studies conducted on the natural pastures of Mongolia [3] showed that the increase in poorly eaten Artemisia adamsii was clearly associated with the pernicious violation of the grazing rate. Iranian researchers confirm that pasture management practices ultimately affect the development and conservation of pasture ecosystems [4]. Thus, the development of ecological methods for the use of natural pastures of arid regions is a global problem for all of their users [5].

In the conditions of Russia, semi-deserts and deserts are the areas of meat, fine-fleece and caracul sheep breeding, beef cattle breeding, horse breeding and camel breeding. At present, the vegetation of the arid zone of Russia has been fairly well studied. Scientists are in search of ways to improve natural desert pastures [6-8].

However, high-cost reclamation is less attractive for most private livestock farms than natural pastures that are the source of "free" food, with year-round free grazing. Such economic activity over the past decades has led to the fact that the livestock load on the natural pastures of the south of Russia has exceeded their capacity 4-6 times [9]. In this regard, the search for new simple and low-cost ways to restore degraded natural pastures is now extremely urgent.

On the basis of the Caspian Institute for Research and Arid Agriculture, multiyear research was carried out on the vegetation cover of natural pastures in the steppe zone, in the Desert steppe subzone (Steppa subdeserta) on light chestnut weakly solonetsous soils.

The research is aimed at the study of the ability of vegetation cover of natural arid pastures different in degree of degradation to self-repair. To this end, the features of the formation of the above-ground biomass of arid natural phytocenosis were investigated in the grazing of animals and in isolation therefrom.

On climatic conditions, the place of the experiment is the most continental and arid part of South Russia. The precipitation here is very low, about 130-260 mm per year. The duration of the period with a temperature above 10°C varies between 165-170 days. The sum of temperatures above 10°C reaches 3,200-3,400°C. Evaporation is 3-5 times higher than the amount of precipitation. The probability of dry and arid years is more than 60%.

Materials And Methods

The object of the research was the vegetation cover of natural pastures with different indicators of pasqual digression. For this purpose, four experimental plots of pasture ecosystems were chosen by the degradation points [10], including:

Plot No. 1 - weakly disturbed ecosystem –1 point; load - 1.0 a.u./ha,
Plot No. 2 - medium disturbed ecosystem –2 points; load - 2.0 a.u./ha,
Plot No. 3 - badly disturbed ecosystem –3 points; load - 3.0 a.u./ha, and
Plot No. 4 - very badly disturbed ecosystem –4 points; load - 5.5 a.u./ha.

The soil type of the experimental plots was determined as light chestnut weakly solonetzic medium loam on calcareous loam under sandy loam.

The botanical composition of the plots at the beginning of the experiment was represented by the following species:

plot 1 - Artemisia absinthium L, Artemisia pauciflora Weber ex Stechm. and Artemisia austriaca Jacq., Poa bulbosa L., Eremopyrum orientale (L.), Festuca valesiaca subsp., Pyrethrum corymbosum L., Anabasis aphylla L., Ceratocarpus arenarius L., Polygonum aviculare;

plot 2 - Artemisia pauciflora Weber ex Stechm, Poa bulbosa L., Eremopyrum orientale (L.), Anabasis aphylla L., Artemisia absinthium L, Lepidium ruderale L., Alhagi pseudalhagi (M.V.);

plot 3- Poa bulbosa L., Esula virgata (Waldst. & Kit.), Ceratocarpus arenarius L., Anabasis aphylla L., Artemisia austriaca Jacq., Ceratocephala falcate;

plot 4 - Ceratocarpus arenarius L., Poa bulbosa L., Lappula squarrosa (Retz.).

On each of these plots, the "isolators" had been allocated - microreserves closed for grazing of animals in four replicates. The registration area of each of them was 25 m2. For three years, comparative field studies of yield dynamics, species composition, projective coverage in pasture and isolation were carried out in these plots to identify the potential for self-recovery (demutation) of the natural grass stand of degraded forage lands.

RESULTS AND DISCUSSION

The choice of plots for researches has been proved by their identity among themselves over relief, soils and vegetation. The natural pastures such as ephemeral-wormwood, wormwood-herbaceous and ephemeral-wormwood-cereal associations have been selected for the experiments. They accounted for about 95% of the total area under study. The selected plots are located on the leased lands of individual sheep farm households. Peasant farms have identical breed and sex and age composition of livestock. The way of keeping and grazing sheep is the same at all plots: year-round free grazing for at least 10 years.

In all the experimental plots in insulators, in the absence of livestock load, the process of self-recovery of the vegetation cover was activated, namely, an increase in its overall projective cover in various pasture phytocenoses (Table 1) occurred.

According to the results of the study, for three years in all isolators, the TPC dynamics was positive, while the increase in the TPC occurred in direct proportion to the magnitude of the livestock load. So, to the greatest extent, the total projective coverage increased by 39% on 4 points plot, by 30% - on 3 points plot, by 21 points - on 2 points plot, and by 6% - on the weakly disturbed plot.

In the grazing areas, the TPC of the grass stand decreased for three years: on Plot No. 1 (1 point) - by 1%, on Plot No. 2 (2 points) - by 3%, on Plot No. 3 (3 points) - by 8%, and on Plot No. 4 (4 points) - by 3%.

The analysis of variance showed significant differences in the years of the study (except for the first year on a 4-point plot where no changes in the vegetation cover occurred).

When studying the dynamics of the yield of the grass cover of the experimental plots (Table 2), the following was noted:

- the process of self-recovery of vegetation was activated in the first year of its isolation from the load on all experimental plots, except for the plot with the very badly disturbed ecosystem - No. 4;

- for three years in the first three plots, there was an active increase in the yield of the grass stand in the isolation in comparison with grazing fields (by 3-5 times);

- on a plot with the very high load (No. 4 - 5.5 a.u./ha) - in the first year, there was no yield increase, in the second year - the difference was insignificant, only in the third year the yield in isolation increased to a significant difference;

- at plots No 1-3, the maximum yield increase was recorded in the second year of isolation.

Starting from the third year, the yield indicator on the first three plots tended to reduction. This was caused by the active vegetation of Roa bulbosa L. in insulators. Without loosening by the hoofs, these areas turned out to be covered by a dense turf of the bulbous Bluegrass, very reminiscent of the piled wool - the raft.

Table 1. Change in the total projective cover (TPC) of the grass stand of the experimental plots during grazing and in isolation

No.	Options	Total projective cover								
		Year of study								
		1st			2nd			3rd		
		Medium %	Diff-erence	MSD_{05}	Medium %	Diff-erence	MSD_{05}	Medium %	Diff-erence	MSD_{05}
1	Grazing	55	8	2.87	56	15	5.02	54	15	2.64
	Isolation	63	-		71	-		69	-	
2	Grazing	40	11	5.47	40	28	2.45	37	35	3.96
	Isolation	51	-		68	-		72	-	
3	Grazing	30	11	3.00	28	34	2.87	22	49	3.57
	Isolation	41	-		62	-		71	-	
4	Grazing	20			19	15	2.77	17	42	2.05
	Isolation	20			34	-		59	-	

Table 2. Dynamics of productivity of natural grass stand by year of study

No.	Options	Yield, t/ha dry weight								
		Year of study								
		1st			2nd			3rd		
		Average, t/ha	Diff-erence	MSD_{05}	Average, t/ha	Diff-erence	MSD_{05}	Average, t/ha	Diff-erence	MSD_{05}
1	Isolation	1.72	-		2.02	-		1.14	-	
	Grazing	0.52	1.2	0.046	0.56	1.46	0.075	0.38	0.76	0.06
2	Isolation	0.71	-		1.60	-		0.90	-	
	Grazing	0.21	0.50	0.044	0.34	1.26	0.059	0.22	0.68	0.057
3	Isolation	0.63	-		1.43	-		0.95	-	
	Grazing	0.15	0.48	0.096	0.26	1.17	0.039	0.19	0.76	0.065
4	Isolation	0.15	-		0.2	-		0.32		
	Grazing	0.15	-		0.15	0.05	0.07	0.15	0.17	0.081

According to the results of three years of the study, it was noted that the elimination of the load on vegetation cover led to a change in the botanical composition of the grass stand. On plots with a high livestock load (3.0 a.u./ha), 7 types of grasses were added to the grass stand: Festúca valesiáca, Agropyron repens L., Galium verum, Stipa lessingiana Trin. et Rupr, Sisymbrium Loeselii, Lappula squarrosa (Retz.), Bromopsis inermis L; at the average load (2.0 a.u/ha) - 6 species: Festúca valesiáca, Agropyron repens L., Agropyrum desertorum, Bromus squarrosus L., Stipa lessingiana Trin. et Rupr, Galium verum; at weak load (1.0 a.u./ha) - 2 species: Astragalus brachycarpus M.Bieb., Sisymbrium Loeselii. On the plot with the very high load (5.5 a.u/ha) in isolation for three years, changes in the species composition did not occur. As a result of a long (more than 15 years) very high livestock load, this plot had a very poor species composition: Ceratocarpus arenarius L., Poa bulbosa and Lepidium ruderale. Three years of vegetation isolation from grazing positively affected only the increase in the projective coverage of these species, which was reflected in a slight increase in the yield of these experiment lots.

Such a study was conducted for the first time in Russia. In the state of New Mexico (USA), where grazing is one of the uses of arid land, there is an argument about what type of grazing is needed in the long-term use of ranch pasture resources in arid climate. Either continuous grazing during the year or season, or a rotary system, when grazing alternates with pasture rest for self-repairing of the vegetation cover are considered.

Holecheck et al. found that the rotational system led to an increase in pasture forage by 7% compared to continuous grazing [11]. However, Briske et al. state that the total biomass of plants was equal to or greater with continuous grazing than with the rotary grazing. It was noted that the increase in pasture forage was observed mainly in the areas with high annual rainfall (> 20 inches). In general, forage production did not increase in the semi-arid and arid areas where the rotary system was used [12].

Our research has shown that in the arid regions of southern Russia with low annual rainfall (≤ 8 inches), the rotational pasture system not only preserves and increases the species composition of the vegetation cover but also gives an increase in biomass of animal forage.

Conclusion

As a result of the studies, the following conclusions have been made:

- The process of self-recovery of the grass stand on semi-desert natural pastures in the arid zone of the south of Russia was recorded from the first year of isolation from grazing with a livestock load of no more than 3.0 a.u./ha.

- The optimal term for excluding the livestock load on weakly and medium-disturbed phytocenoses should be no more than 2 years.

- A prolonged load of animals of more than 5.5 a.u./ha on pasture phytocenoses leads to the fact that the demutation process in these phytocenoses is suspended, even when isolated from any anthropogenic influences.

Studies have shown that a prolonged high load on dry-steppe pasture phytocenoses under conditions of light chestnut soils leads not only to their specific impoverishment but also to the loss of the seed stock of the pasture plant species in the soil, that is, the self-recovery of such a vegetation cover is either impossible, or requires a prolonged (more than 3 years) isolation. As a result, such pastures need only deep biological reclamation with the cultivation of land, sowing grass, etc. Therefore, along with the obligatory observance of the livestock load, it is necessary to partially remove the part of the agricultural land used for grazing from the grazing turnover for two years. The first year of "full rest" - for self-seeding; the second year - the grass stand can be used for grazing in late autumn (starting from November) and in winter or for haying. On a larger scale, it is necessary to create steppe genetic reserves (green zones or rest zones).

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References

1. Holechek, J.L., Gomes, H.S., Molinar, F., Galt, D., Grazing intensity: Critique and approach, *Rangelands* 1998, *20*, 15–25.
2. Waldron, B.L., Eunb, J.-S., ZoBell, D.R., Olsonc, K.C., Forage kochia (Kochia prostrata) for fall and winter grazing, *Small Ruminant Research* 2010; *91(1)*, 47-55.
3. Tserenpurev, Bat-Oyun, Masato Shinoda, Yunxiang Cheng and Yadamjav Purevdorj. Effects of grazing and precipitation variability on vegetation dynamics in a Mongolian dry steppe. Journal of Plant Ecology, 2016; 9(5): 508–519.
4. Chaichi, MR., Saravi, M.M., Arash, M., Effects of livestock trampling on soil physical properties and vegetation cover (Case Study: Lar Rangeland, Iran), *Int. J. Agric. Biol.* 2005, *7*, 1-5.
5. Dregne, H.E., *Desertification costs: Land damage and rehabilitation,* Report to the United Nations Environment, Nairobi 1991.
6. Voronina, V.P., Povysheniye bioproduktivnosti aridnykh pastbishch [Increase of bioproductivity of arid pastures], *Izvestiya of NV AUK* 2012, *1*, 16-21.
7. Nidyulin, V.N., Produktivnost' obraztsov kokhii prostertoy (Kochia prostrata (L) Schrad.) v Severo-Zapadnom Prikaspii [Productivity of samples of kohia extruded (Kochia prostrata (L) Schrad.) in the North-Western Caspian Region], *Kormproizvodstvo* 2013, *1*, 24-26.
8. Dedova, E.B., Ispol'zovaniye netraditsionnykh kul'tur v kachestve fitomeliorantov [Use of non-traditional crops as phyto-meliorants], in *Materials of the 1st regional conference of young scientists "New and rare plants of the North Caucasus"*, Part II, Vladikavkaz 2003, pp. 54-56.
9. Zvolinskiy, V.P., Issledovaniye vliyaniya pastbishchnogo zhivotnovodstva na stepnyye ekosistemy Astrakhanskoy oblasti [Investigation of the influence of grazing farming on steppe ecosystems of the Astrakhan region], *Bulletin of the Russian Academy of Agricultural Sciences* 2011, *2*, 23-25.
10. Yevstifeyev, Yu.G., Rachkovskaya, Ye.I., Gunin, P.D., *Osnovnyye tipy ekosistem. Pustyni Zaaltayskoy Gobi* [The main types of ecosystems of the Zaaltayskaya Gobi Desert], Moscow 1986, pp. 157-164.
11. Holecheck, J.L., Gomez, H., Molinar, F., Galt, D., Grazing studies: What we've learned, *Rangelands* 1999, *21*, 12-16.
12. Briske, D.D., Derner, J.D., Brown, J.R., Fuhlendorf, S.D., Teague, W.R., Havstad, K.M., Gillen, R.L., Ash, A.J., Wilms, W.D., Rotational grazing on rangelands: Reconciliation of perception and experimental evidence, *Rangelands Ecology and Management* 2008, *61*, 3-17.