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ENVIRONMENTAL MONITORING OF PASTURES LOCATED NEAR THE VILLAGE BIRSUAT OF ENBEKSHILDER DISTRICT IN AKMOLA REGION

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Annotation

The article presents the results of the ecological monitoring of pastures located near to the village Birsuat of Enbekshilder district in Akmola region – the study of cultural-technical and agrochemical condition of the soil, botanical composition of herbage and pasture yield in connection with the agroclimatic indicators. It is established that the soil of pastures have a very low content of nitrate nitrogen, phosphorus and low content of humus, grasslands are defined as low-productive brome-wormwood-elymus-fescue-feather pastures.

Keywords: monitoring, phytotopological evaluation, phytocenological evaluation.

Introduction

According to the Law on pastures of the Republic of Kazakhstan, which is aimed at improving the condition and infrastructure of pastures, prevention of pasture degradation processes, the competence of local executive body of region (village), is responsible for conducting the geobotanical survey of pastures [1]. Geobotanical survey of pastures conducted in combination with soil and agroclimatic survey is the environmental monitoring of pastures.

Ecological monitoring of pastures is a system of observations and control of the condition of grasslands with the aim of timely identifying the changes that occur with it to develop appropriate measures and make management decisions.

According to the Department of land relations, the area of pasture in Akmola region is 6,7 million ha, including the area of degraded pastures – 1,4 million ha (20%). The ecological condition of pastures is extremely poor. Their productivity in the steppe zone does not exceed 0,3-0,5 t/ha in the dry zone – 0,2-0,3 t/ha of hay. Currently, there is no data on the ecological condition of grasslands in Akmola region, geobotanical survey of them had not been carried out since 1991 [2, p.7].

Environmental monitoring is a multi-level system. There are distinguished systems of local, regional, national and global levels [3]. However, only at the level of villages, taking into account the precise circumstances of the natural condition of the grasslands, types and intensity of commercial pressures on them, it is possible to develop a scientific concept

for environmental monitoring and to solve the problem of its practical implementation [4].

The relevance of carrying out environmental monitoring of pastures located close to villages is caused by the high degree of degradation due to excessive grazing of farm animals within a radius of 5 km from the border villages.

In this regard, the aim this research was to conduct environmental monitoring of pastures located near to the village Birsuat of Enbekshilder district in Akmola region.

The objectives of the research:

- Phytotopological evaluation of pastures;
- Phytocenological evaluation of pastures;
- Definition of pasture productivity;
- The correlation analysis of pastures ecological monitoring data.

The materials and methods of research

Environmental monitoring of pastures was carried out in 2013-2016 on pastures located in LLP "Baymyrza-agro" in pastures located in the radius of 5 km from the village of Birsuat of Enbekshilder district in Akmola region. The total area of pastures is 3386 hectares.

Agrochemical examination of pastures was conducted in accordance with methodological guidelines on carrying out of agrochemical inspection of soils of agricultural lands [5]. Soil chemical analysis was carried out in the laboratory of LLP "AgroComplexExpert", located in the village of Zhaksy of Zhaksy district in Akmola region.

Determining pasture mass was conducted by the hay method according to the method of accounting for the productivity of hayfields and pastures of the forwarding works [6]. The botanical composition of herbage was determined by the determinants [7, 8]. For the objectiveness of the assessment of agroclimatic resources there were used two methods: calculation of the hydrothermal coefficient (HTC) by Selyaninov G.T. [9] and bioclimatic potential (BCP) by Shashko D.I. [10].

Mathematical processing was performed using the program Statistika.

Main results and discussion of the obtained data

Due to the fact that the process of a ground study of the conduction of ecosystems over large areas is difficult, very popular to study the environmental conduction of the lands on the basis of remote monitoring data [11-13]. However, remote monitoring based on finding correlations between the various data received from the satellite involves the loss of some information. When the pasture is monitored, it is important to be guided by ground-based studies, which are the most reliable.

Phytotopological evaluation of pastures meant the definition of cultural-technical condition and carrying out agrochemical inspection of soils. By cultural-technical condition pastures are good, the presence of

bumps in the studied areas does not exceed more than 3%.

According to the literature [2, p. 9], about half of all agricultural land of Enbekshilder district have an average content of humus, nitrogen and phosphorus (table 1). Against the average level of soil fertility of Enbekshilder district as a whole, the soils in the pastures located near the village Birsuat, have a relatively low content of available nutrients.

Table 1 – Agrochemical characteristics of the soil of the pastures located near the village Birsuat

The area of pastures	Agrochemical parameters of soils				
	$N\text{-}NO_{3,}$ mg/kg (0-40 sm)	$P_2O_{5,}$ mg/kg (0-20 sm)	K_2O, mg/kg (0-20 sm)	Humus, % (0-20 sm)	pH (0-20 sm)
Average	4	10,01	410	2,7	8,67

Soil – the southern black soils, with very low content of nitrate nitrogen (4 mg/kg), very low content of mobile phosphorus (10,01 mg/kg) and high content of potassium (410 mg/kg). The percentage of the humus content of the soil is 2,7%. The soil acidity is medium alkaline (pH = 8,67).

Phytocenological evaluation of pastures (determination of botanical composition of herbage) showed the great diversity of plants.

Plants that occur sometimes: *Stipa capillata, Artemisia Lercheana*, *Achillea millefolium*, *Linaria vulgaris*, *Chamaecytisus ruthenicus*, *Taraxacum officinale*, *Phlomis tuberosa*, *Leontodon autumnalis*, *Lamium purpureum*, *Hibiscus trionum*, *Plantago arenaria*, *Salvia nutans*, *Polygonum aviculare*, *Galium verum*, *Polycnemum arvense*, *Potentilla argentea*, *Ranunculus abchasicus*, *Capsella bursa-pastoris*, *Filipendula ulmaria*, *Centaurea jacea*, *Astrodaucus orientalis Anthriscus sylvestris*, and *Trifolium arvense*.

The dominant plants growing everywhere, are presented in table 2.

Table 2 - Botanical composition of herbage of the pastures located near the village Birsuat

Name of plants	Density of stems by years, PCs/m^2									
	2013	%	2014	%	2015	%	2016	%	av.	%
Bromus inermis	28	65	26	65	27	63	35	62	29	64
Elymus junceus	16		16		14		18		16	
Festuca ovina	15		10		11		16		13	
Festuca varia	11		10		12		17		13	
Stipa Lessingiana	10		10		9		14		11	
Carex praecox	18		18		21		17		19	
Artemisia austriaca	14	35	15	35	17	37	18	38	16	36
Artemisia vulgaris	20		17		18		26		20	

Total	132	100	122	100	129	100	161	100	137	100

According to the prevailing agro-climatic conditions, the density of stems varied. By hydrothermal coefficient of Selyaninov G.T. (HTC), 2013 was excessively irriguous (HTC = 1,34), according to the bioclimatic potential by Shashko S.V., low productive (BCP = 1,06), the density of stems was 132 PCs/m^2.

2014 was temperately dry (HTC = 0,97) and very low productive (BCP = 0,80), the density of stems was 122 PCs/m^2.

2015 was provided by moisture (HTC = 1,1), but very low productive (BCP = 1,05), the density of stems was 129 PCs/m^2.

The most moistened year among four years of research was 2016 according to hydrothermal coefficient excessively irriguous (HTC = 1,38), by bioclimatic potential low productive (BCP = 1,56). The density of stems in 2016 was the maximum 161 PCs/m^2.

A substantial part of the herbage was badly eaten plants of *Artemisia austriaca* and *Artemisia vulgaris* (35-38%).

The presence of wormwood (*Artemisia*) in pasture phytocenoses indicates the processes of their degradation. Wormwood-cereal pastures with Austrian wormwood are herbage that resulted from intensified grazing [14].

Other plants are related to valuable forage grasses (62-65%).

100 kg of hay of *Bromus inermis* contains 29,3 feed units and 3 kg of digestible protein, *Elymus junceus* - 31,3 feed units and 7,7 kg of digestible protein, *Festuca ovina* - 29,3 feed units and 5,7 kg of digestible protein, *Festuca varia* - 26,5 feed units and 2,9 kg of digestible protein, *Stipa Lessingiana* - 35,0 feed units and 4,5 kg of digestible protein.

In accordance with the prevailing agro-climatic conditions and the density of the stems, a pasture mass was formed (Table 3).

Table 3 – Yields of the pastures located near the village Birsuat

Yield indicator	Years of research				
	2013	2014	2015	2016	on average in 2013-2016
Pasture mass, t/ha	2,6	1,7	2,0	2,5	2,2
LSD_{05}	0,19	0,26	0,25	0,27	

In the period from 2013 to 2016 the yield of the pasture mass fluctuated greatly. In 2014 yield of pastures decreased by 65% (from 2,6 to 1,7 t/ha), in 2015 - increased by 18% (from 1,7 to 2,0 t/ha) and in 2016 it increased significantly by 25% (from 2,0 to 2,5 t/ha).

Despite the fact that in 2016 pasture plants were more provided with moisture (HTC = 1,38) in comparison with 2013 (HTC = 1,34), in 2016 the productivity of pastures is less than in 2013 (2,5 and 2,6 t/ha, respectively). The average for the 4 years of the

research productivity of pasture located near the village Birsuat was 2,2 t/ha.

The main agroclimatic indicators influencing the formation of the yield of pastures is given in table 4.

Table 4 – Agroclimatic resources of Enbekshilder district in Akmola region

Indicators	Years				
	2013	2014	2015	2016	on average in 2013-2016
Precipitation, mm	478	406	405	449	434
Σ of temperatures > +5°C	2183	2241	2471	2542	2359
Σ of temperatures > +10°C	1761	1927	2110	2302	2025
Σ of temperatures > +15°C	1292	1185	1366	2046	1472
HTC	1,34	0,97	1,10	1,38	1,20
BCP	1,06	0,80	1,05	1,56	1,12

The correlation analysis of environmental monitoring data showed the following results. Sums of positive temperatures above +5°C, +10°C did not affect the yield. The sum of temperatures above +15°C affected to the yield in average degree (r = 0,53). The average correlation was also noted between the yield of pastures and bioclimatic potential (r = 0,70). The major factor limiting yields is the moisture, there is strong correlation of yield with annual rainfall (r = 0,93) and hydrothermic coefficient (r = 0,98).

Conclusion

By cultural-technical condition pastures located near the village Birsuat of Enbekshilder district in Akmola region are good. Soil – the southern black soils, with very low content of nitrate nitrogen (4 mg/kg), very low content of mobile phosphorus (10,01 mg/kg) and high content of potassium (410 mg/kg). The percentage of the humus content of the soil is 2,7%.

The herbage of the pastures revealed a large diversity of plant species, including valuable forage (*Bromus inermis, Elymus junceus, Festuca ovin, Festuca varia, Stipa Lessingiana*) and badly eaten plants (*Artemisia austriaca, Artemisia vulgaris*). In the period from 2013 to 2016 there was a decrease in the ratio of valuable and increased badly eaten plants (from 65/35% to 62/38%).

The yield of pastures varied greatly in the years of the research due to agro-climatic conditions, amounting to 1,7 t/ha in 2014 (HTC = 0,80) to 2,6 t/ha in 2013 (HTC = 1,34). In 2016, despite the best moisture conditions, there was a decrease in pasture mass compared to the starting position in 2013.

Such a poor level of soil fertility, gradual increase in the content of wormwood in the herbage and a decrease in the yield of the pastures means that active processes of

degradation and causes the necessity to take measures to improve pastures.

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Резюме

По культуртехническому состоянию пастбища, расположенные на землях поселка Бирсуат Енбекшильдерского района Акмолинской области в хорошем состоянии. Почвы исследуемых пастбищ обладают очень низким содержанием нитратного азота, очень низким содержанием подвижного фосфора, высоким содержанием калия, низким содержанием гумуса в почве. Угодья определены как кострецово-полынно-волоснецово-овсяницево-ковыльные пастбища с очень низкой урожайностью 1,7-2,6 т/га пастбищной массы. В период с 2013 по 2016 гг. отмечено повышение в травостое содержания плохо поедаемых растений и снижение общей продуктивности пастбища.

Түйін

Мәдени-техникалық жағдайы бойынша Ақмолы облысы Енбекшілдер ауданындағы Бірсуат елді мекенінде орналасқан жайылымдар жақсы деп бағаланды. Зерттелген жайылымдар топырақтары өте төмен мөлшердегі нитратты азоттан, өте төмен мөлшердегі жылжымалы фосфордан, жоғары мөлшердегі калийдан, төмен мөлшердегі топырақ қарашіріндісінен тұрады. Мал азықтық жерлер өнімділігі төмен жайылымдық массасы 1,7-2,6 т/га-дан аспайтын арпабасты-жусанды-селеулі-жауқияқты-бетегелі жайылымдар болып анықталды. 2013-2016 жылдар аралығында шөп оттылығындағы нашар желінетін өсімдіктердің көбейуі және жалпы жайылым өнімділігінің төмендеуі байқалды.