

Ecological State of Irrigated Sieriozem-Medging Soils and Ways to Improve Them

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Abstract: The purpose of scientific research work is to study the ecological state of irrigated sieriozem-meadow soils and develop scientific recommendations for their improvement. Soil pollution is a type of anthropogenic degradation, in which the content of chemicals in soils subject to anthropogenic impact exceeds the natural regional background level. Exceeding the content of certain chemicals in the human environment (compared to natural levels) due to their intake from anthropogenic sources is an environmental hazard.

Keywords: Sieriozem-Meadow Soils, Assessment, Efficiency, Maximum Allowable Concentration (MPC), Chemical Substance, Ecological State, Improvement.

1. Introduction

On the territory of the city of Jizzakh there are many enterprises that have a negative impact on the environment, some of them can be attributed to large and medium-sized industrial enterprises. (Battery plant JV "UzEksid", LLC "Ecoclimat" for the production of glass wool, LLC "Sofitel" for the production of ultramarine pigment, Jizzakh flour mill, asphalt plants, LLC Jizzakh oil depot, Jizzakh plastic plant, etc.)

Jizzakh is a large metropolis in the Jizzakh region and this places a special responsibility on ensuring its environmental safety, the integrity of the ecosystem and the health of its inhabitants.

Every year, more than 26.2 thousand tons of pollutants are emitted into the atmospheric air of the city from industrial enterprises and vehicles, which is 0.9% of the total gross emissions of pollutants in the republic. There is a tendency to reduce emissions of pollutants, both in industry and in transport [Alikhanov, 2008].

The scientists S.A. Shoba, N.G. Rybalsky (2013). The analysis of the concepts of "soil" and "earth" existing in modern scientific and legal practice has been carried out. The theoretical principles of the ecological regulation of soils and lands based on establishing the relationship between their state and anthropogenic impact on them and determining the permissible boundaries of the state and levels of impact are outlined. The characteristics of the sources of anthropogenic impact on soils and lands are given. A system of criteria for assessing and indicators of soil and land quality and anthropogenic impact has been proposed, taking into account natural conditions and types of economic use of land [Shoba, Yakovlev, Rybalsky, 2013].

Researchers O.L. Voskresenskaya and V.S. Resurrection (Yoshkar-Ola, 2020). To analyze the content of chlorine ions in the urbanozems of the roadside and on the lawns of the urban district in the city of Yoshkar-Ola. The phytotoxicity of urbanozems was studied in terms of germination energy and seed germination of white mustard and oats. We studied the effect of soil salinity on the state of the assimilation apparatus of test objects in terms of the content of photosynthetic pigments. Conclusions: the analysis of the content of chlorine ions in the urbanozems of the roadside and on the lawns of the territory of the urban district "City of Yoshkar-Ola" made it possible to establish that the studied areas had soils with low salinity. From 2019 to 2020, there was a downward trend in the number of chloride ions in different functional areas of Yoshkar-Ola, which may be due to a decrease in the use of anti-icing agents in recent years. The study of the phytotoxicity of urbanozems in terms of germination energy and seed germination of white mustard and common oats showed that the average phytotoxicity of the studied soil samples was the highest in the industrial zone of Yoshkar-Ola. The soils of the residential zone had an average phytotoxicity (Voskresenskaya, Voskresensky, 2020).

The assessment of the ecological state of soils of some railway facilities of the Central Administrative District of Moscow was carried out by a researcher at the Moscow State University named after M.V. Lomonosov Makarov A.O. (2014). The analysis of studies and regulatory and methodological documents in the field of assessing and regulating the state of soils and other environmental components in the zones of influence of railway transport has been carried out. [Makarov, 2014].

A comprehensive study of the seasonal dynamics of the main properties and biological activity of gypsum soils, the development of criteria for an indicator of their degradation in the Jizzakh region was carried out by a

researcher at the National University of the Republic of Uzbekistan Makhkamova D.Yu. The dynamics of seasonal changes in the physiological groups of microorganisms, enzymatic activity and respiration of soils by the content of gypsum and the degree of salinity of gypsum soils of the Jizzakh steppe have been substantiated, indicators have been developed for indicators of biological activity (BA), general relative biological activity (RBA) and degradation of gypsum soils [Makhkamova, 2018].

Agrophysical properties and salt regime of irrigated pasture soils (on the example of the northwestern part of the Jizzakh desert) were studied by the scientific prospector Abdushukurova Z.Z. It has been established that under the influence of irrigation on some sulfur grass soils, silt particles are washed out from the upper layer down. It has been established that the soils of these regions differ not only in their multilayeredness, but also in their lightness, mainly in their mechanical composition (Abdushukurova, 2010).

Research work on technogenic disturbance of irrigated soils, their ecological state and reclamation (on the example of the Tashkent region) was carried out by a researcher at the National University of Uzbekistan Zhobborov B.T. He determined the technogenic disturbance and ecological state of irrigated sierozem-meadow soils and dark sierozems, changes in their chemical, physical, biological properties, as well as the development of appropriate remediation measures [Zhobborov, 2019].

He was engaged in scientific work on the effectiveness of the effect of fertilizers on the fertility of gray-meadow soil and the yield of sorghum, a researcher at the Institute of Soil Science and Agrochemistry of the National Academy of Sciences of Azerbaijan (2018). The article discusses the effect of organic fertilizers obtained on the basis of waste separately and together with mineral fertilizers under the sorghum culture in the conditions of sierozem-meadow soils of the Ujar region of Azerbaijan. The results of the studies showed that fertilizers obtained on the basis of local organic waste (Shirvan compost) had a positive effect on the dynamics of nutrients in the soil and the yield of sorghum [Rustamova, 2018].

Researchers of the Omsk Agrarian Research Center and Omsk State Technical University studied the influence, long-term systematic use of mineral and organic fertilizers in the grain-grass crop rotation on the fertility elements of the meadow-chnozem soil, the yield and quality of spring wheat grain. In a long-term stationary experiment on the meadow-chnozem soil of the forest-steppe zone of Western Siberia, it was found that the cultivation of perennial grasses in the crop rotation, the application of straw in combination with the rational use of mineral fertilizers allows maintaining soil fertility and increasing the productivity of crops [Balabanova, Voronkova, Doronenko, 2018].

Literature analysis shows that the research on the ecological state of irrigated sierozem-meadow soils and ways to improve them above indicated by the researcher is considered insufficient.

2. Materials And Methods

1. Experimental site.

The experimental plot is irrigated gray-meadow soils of the Yakub farm in Sh. Rashidov district of Jizzakh region.

Jizzakh region is located in the middle part of the Republic of Uzbekistan. It borders on the southern side of the Samarkand region, on the eastern side of the Syrdarya region, on the north-western side of the Aidar-Arnasay lake system, on the northern side of the Republic of Kazakhstan. The territory is 21179 km², the population is about 1350 thousand people.

Today Sh. Rashidovsky district is one of the territories where the quality of agricultural land has decreased, the main lands of the district are located near the city center, industrial enterprises pollute the soil with various pollutants, the natural balance is disturbed and the ecological environment is polluted.

The industrial sector releases large amounts of pollutants into the biosphere, which then penetrate the soil. In this case, the soil can be polluted both directly and indirectly, by the deposition of pollutants in the atmospheric air or the aquatic environment.

2. Applied methods. Methods of agrochemical analysis

The following methods were used in the agrochemical analysis of the soil: "Methodology for the agrochemical analysis of soil and plants" (Tashkent, 1977) E.V. Arinushkin. "Guidelines for the chemical analysis of soils" (Moscow, 1970), GOST 26423-85 "Methods for determining the specific electrical conductivity, pH and solid residue of wastewater"; GOST 26428-85. The manual "Method for determining calcium and magnesium in aqueous extraction" was used. MVI O'zO'U 0704:2016 The presence and amount of heavy metals were determined by mass spectral analysis (mass spectrometer ISP-MS) using the "Measurement Methods" of the Republic of Uzbekistan.

Bicarbonates of calcium, magnesium and chlorine by titration; sulfates by precipitation; ammonium nitrates and nitrites by the photometric method on a KFK-3 photocolormeter; The amounts of sodium and potassium were determined with a PFA-378 flame photometer.

Materials and methods of research:

Consideration and study of the functional diversity of microbial communities in the soil and plant rhizosphere has traditionally been carried out at the level of physiological groups in the appropriate medium: ammonifying bacteria on meat-peptone agar (MPA), spore bacteria with the addition of MPA. (1:1), oligonitrophils, actinomycetes on a starch-ammonia medium, microscopic fungi on Chapek's medium [Zvyagintsev, 1991]. The number of bacteria is expressed in colony-forming units per 1 g of soil.

Analysis of the diversity of bacteria in the soil and rhizosphere at the level of taxonomically heterogeneous physiological groups, such as ammonifiers, oligonitrophils, actinomycetes, microscopic fungi, showed that oligonitrophilic bacteria grow more intensively, their number ranges from 32 to 98 thousand/g, ammonifiers in 38- 72 thousand/g, actinomycetes - 5-24 thousand/g and fungal populations - 2.0-11.0 thousand/g.

3. Results And Discussion

Materials and methods of research:

Soil samples under various plants of the Jizzakh region served as an object for the isolation of microorganisms. Accounting and study of the functional diversity of microorganism communities in soils and plant rhizospheres was traditionally assessed at the level of physiological groups on the appropriate media: ammonifying bacteria on meat-peptone agar (MPA), spore bacteria on MPA with the addition of wort (1:1), oligonitrophils on Ashby medium, actinomycetes on a starch-ammonia medium, microscopic fungi on Chapek's medium [Zvyagintsev, 1991]. The number of bacteria was expressed in colony forming units per 1 g of soil (CFU/g).

Table 1. The number of physiological groups of microorganisms in the soil(cfu/g soil)

№	Place of selection	Ammoni fixators, KOEx10 ⁶	Spore KOEx10 ⁴	Oligonitrophils KOEx10 ⁵	Nitrogen clamps KOEx10 ⁴	Actinomycetes KOEx10 ⁴	Microscopic mushrooms KOEx10 ³
1	I rhizosphere	72*10 ⁵	72*10 ³	53*10 ⁵	12*10 ⁴	6*10 ⁴	2*10 ³
2	II rhizosphere	47*10 ⁶	74*10 ³	32*10 ⁵	7*10 ³	7*10 ⁵	11*10 ³
3	III rhizosphere	42*10 ⁶	37*10 ³	98*10 ³	-	22*10 ⁴	6*10 ⁴
4	IV rhizosphere	38*10 ⁵	36*10 ⁴	48*10 ⁴	6*10 ⁴	18*10 ⁴	9*10 ³
5	I 0-30 cm	63*10 ⁵	18*10 ³	86*10 ⁴	8*10 ⁴	19*10 ⁴	4*10 ³
6	II 0-30 cm	59*10 ⁵	24*10 ³	48*10 ⁴	-	5*10 ⁴	2*10 ³
7	III 0-30 cm	43*10 ⁵	22*10 ⁴	74*10 ³	1*10 ³	7*10 ⁴	3*10 ⁴
8	IV 0-30 cm	52*10 ⁵	40*10 ³	97*10 ³	-	24*10 ³	1*10 ³

One of the directions of soil purification is phytomelioration, which is based on the ability of some plant species to withstand high concentrations of toxic elements and absorb them throughout their life. The selectivity of plants to highly concentrated components and their ability to accumulate high concentrations of toxicants are dangerous from the point of view of their access to food chains, but can be used for phytomelioration. At the All-Russian Research Institute of Hydraulic Engineering and Land Reclamation, A. N. Kostyakova conducted research on the reclamation of wheat and legumes. It has been established that these plants are distinguished by a high release of Cu, Zn, Pb, Cd and can be used as a phytomeliorant for cleaning soils contaminated with heavy metals.

4. Field Research Methods

The studies were carried out in accordance with the established system of experience in the fields of the Yakub farm in Sh. Rashidov district, Jizzakh region in 2020-2022 on the Durdona variety.

The studies were carried out under the conditions of irrigated sierozem-meadow soils (2020-2022) in 4 variants, 4 repetitions. The surface area of each option was 50 m², with a total area of 1500 m².

Experimental system 1 option control overseeding mung bean (without fertilizer) and 2 option overseeding mung bean (biofertilizer 20t/ha), option 3 overseeding mung bean (Rizocom-1), option 4 overseeding mung bean (biofertilizer 20t/ha) + Rizocom-1).

In the experiment, the secondary culture variety Durdon was planted and studied according to the seeding rates established in the recommendations.

Agrotechnique of transplantation.

A machine was planted in the research field. Phosphorus and potassium are introduced during autumn plowing by cultivation after sowing.

In the experiment, after harvesting winter wheat, the seeds of the Durdona variety (purity 98.5%, fertility 92%) were sown at a depth of 5-6 cm with seedlings of Fankhauzer-2115 based on resource-saving technologies at a rate of 25 q/ha.

Irrigation was carried out at the rate of 600 m³/ha for seed germination. The aisles were weeded 2 times by hand. Mung beans are re-harvested by hand in the last ten days of September.

5. Conclusion

A complex of soil properties that determines the degree of their compliance with the natural and climatic conditions of soil formation and suitability for the sustainable functioning of natural and anthropogenic ecosystems.

Soils have natural diversity and are a universal indicator of the state of the natural environment (including at the level of natural zones and administrative regions). Therefore, soil disturbance under the influence of any impact (pollution, erosion, forestry and agricultural activities, etc.) indicates the unfavorability of the ecosystem as a whole.

6. References

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