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Efficiency of Phytomeliorative Measures in Saline Lands and Scarcity of Water Resources

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Abstract: The article provides an analysis of global climate change and its impact on the further development of agriculture in Uzbekistan and the problems associated with soil salinization and the growing shortage of irrigation water in the country. On the example of the irrigated lands of the Bukhara region, where there is a large shortage of water and the region is highly susceptible to the negative impact of frequently repeated dry years and an increase in the area of saline lands. In the conditions of meadow alluvial soils prone to salinization and in nearby low-mineralized waters, phyto-melioration measures are proposed to combat soil salinization and water conservation during leaching irrigation: growing sorghum two-color (Sorghum Moench).In the planted variant of the phytomeliorant plant, the intensity of salt restoration at the end of the growing season was lower than in the control (plowed) variant. At the end of the growing season, the coefficient of salt accumulation in the soil in terms of chloride ion was 2.0 in the field planted with white corn and 5.38 in the field not plowed, and 45.9 - 49.1 t/ha of grain and 216-234 t/ha from white corn. The mass of white corn stalks was harvested. In the experimental field, the highest salinity was observed in the plowed and uncultivated fields, with an average of 5146-5227 m^3/ha of water consumed over the years, an average of 2754-2965 m^3/ha in three years.

Keywords: Climate change, water scarcity, irrigation regime, plants, phytomelioration, saline soils, water-physical properties of soil, irrigation rate, irrigation rate, yield, salt regime, reclamation, efficiency, leaching, leaching rate, water saving.

Introduction

The problem of global climate change is on the agenda of mankind, with not only the average annual temperature rise on the planet, but also changes in the entire geosystem, the rise of the world's oceans, melting ice and permanent glaciers, increasing uneven rainfall, changing river flow patterns and climate instability. other changes involved.

As a result of global climate change, the area of glaciers in Central Asia has shrunk by about 30 percent over the last 50-60 years. It is estimated that the volume of glaciers decreases by 50

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percent when the temperature rises to 2^0C and by 78 percent when heated to 4^0C. According to estimates, by 2050, water resources in the Syrdarya basin are expected to decrease by 5%, and in the Amudarya basin - by 15%. The total water deficit in Uzbekistan until 2015 was more than 3 billion cubic meters, by 2030 it will reach 7 billion cubic meters, and by 2050 - 15 billion cubic meters [1, 21].

According to the schemes of integrated use and protection of water resources of the Amudarya and Syrdarya basins, the average long-term water intake limit for the Republic of Uzbekistan is 64 billion cubic meters. At the same time, in the 1980s the annual water consumption of the republic was within the multi-year limit, and in recent years the average annual water use was 51-53 billion cubic meters, including 97.2% from rivers and streams due to global climate change and transboundary water use problems, 1.9 per cent using collector networks and 0.9 per cent using underground, a 20 per cent reduction over the allocated water intake limit [20].

The area of irrigated land in the country is 4.3 million hectares, with an average of 90-91% of total water resources in agriculture, 4.5%, utilities, 1.4% in industry, 1.2% in fisheries, 0.5% in thermal energy, and 1 percent in other sectors of the economy.

The territory of the republic has its own soil and climatic conditions, and as a result of lack of natural drainage, high level of groundwater mineralization, a number of areas are "primary salinity". At the same time, as a result of irrational use of water resources and the negative impact of other anthropogenic factors, “secondary salinization” of lands was observed in some areas, with 45.7% of irrigated land being saline to varying degrees.

Under the influence of natural factors, an increase in the area of saline lands is predicted. So, under the influence of natural factors, slightly saline territories in 2050 will amount to 52.3-55.9%, and by 2100 they will decrease to 49.4-54.5%. medium saline areas will amount to 31.2-33.4% in 2050, and by 2100 they will increase to 32.4-34.6%, and highly saline areas will amount to 12.9-14.3% in 2050, and by 2100 they will increase to 13.1-16% [2].

In the context of growing water shortages, the rational use of water resources, the introduction of water-saving technologies in irrigation and saline leaching, the optimization of soil water, salt, nutrients and other soil regimes through phytomeliorative measures to improve the reclamation of saline soils are urgent issues. is calculated [3,4, 13].

Efficient use of irrigation water, introduction of resource-saving technologies in irrigation and saline washing, protection of the environment and widespread use of biological methods in their implementation are among the most pressing issues facing the world today [5,14, 15, 16, 17, 22].

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Plants that grow in saline soils and are adapted to growth and seed production are called halophytes: "galos" - saline, salt; "Phyton" means a plant, ie saline plants. Halophytes can grow in saline soils by the following characteristics and adaptations: they contain large amounts (up to 30%) of ash; the concentration of tissue fluid is very high and the osmotic pressure of the tissue is also very high, reaching 100-150 atmospheres.

In the desert regions of Uzbekistan, halophytes are found in salt marshes and bald areas, around saline areas. The main salt-tolerant crops grown in Uzbekistan are: sugar beet, sunflower, barley and white oats. Medium salt-tolerant crops are alfalfa, rice, cotton, wheat, corn, potatoes, carrots, onions, tomatoes, melons, cucumbers, pomegranates, jida, quinces, figs, and grapes. Salt-tolerant crops are fruits and legumes [6].

In his scientific research on improving the reclamation of soils in the lower reaches of the Amudarya and desalination of saline soils by phytomelioration, he selected the golden variety Portulaca oleracea in the saline areas of Khorezm region, as well as halophyte (AL), Alopecia (TH), Alopecia (TH) GG), Alhagi pseudalhagi, Karelinia caspia (KC) and Chenopodium album (CA) were planted and its salinity assimilation was assessed: Portulaca oleracea plant has the ability to absorb up to 20% of topsoil salts in saline soils and can be used in food and livestock; The Chenopodium album halophyte plant, typical of the Khorezm region, can be recommended to the region as a plant that is widely saline-absorbing and highly biomass-producing; The Chenopodium album halophyte plant can also be widely used in the pharmaceutical industry; Apocynum lancifolium and Karelinia caspia halophyte plants can be used as saline assimilation and fodder bases for livestock; Abundant and high-quality yields of cotton, wheat, corn and other crops can be obtained after phytomelioration by placing the studied plants in a crop rotation system [7, 23, 24].

During the study of salt tolerance of plants in the desert regions of Central Asia, it was observed that peas and autumn peas died from legumes when the amount of salt in the soil in the 0-100 cm layer reached 0.025-0.028% of chlorine ions and 0.65-0.7% of the dry residue. Cotton, sugar beet, white oats, and alfalfa continued to grow. [8]

Drought-resistant and salt-tolerant and salt-absorbing crops: Maxsar and Tariq are planted in the fields of Bukhara region, where the average salinity and groundwater depth is 1.5-2.0 meters, in the fields emptied of winter wheat. a decrease in the intensity of salt accumulation, resulting in a decrease in saline washout norms as well. As a result of the application of the phytomelioration method, the salt regime of the soil was improved, and the salinity leaching norms were reduced by up to 25% [9].

Melioration in the sense of the word itself is aimed at improving the land, the environment. It can be achieved with the help of plants,

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phytomelioration. Biological reclamation of degraded lands using ecologically specialized species of xerophytes, halophytes, psammophytes and hygrophytes is a reliable way of preserving, enriching and protecting the biodiversity of natural and agricultural ecosystems. In recent years, disturbed soils have been removed from economic circulation everywhere, but the process of restoring their optimal properties is rather slow, and in some places soil degradation continues. Measures are needed to restore degraded soils and, above all, restore their lost structure. Phytomeliorant plants have great potential for solving these issues [10,11]

Irrigated lands of the Bukhara region make up 275.1 thousand hectares, of which 170.1 thousand hectares (61.8%) of lands with groundwater mineralization 1-3 g/l, 96.3 thousand hectares (35%) of lands with mineralization groundwater 3-5 g/l, 8.5 thousand hectares (3.1%) of land with groundwater mineralization 5-10 g/l and 1.2 thousand hectares (0.45%) of land with groundwater mineralization more than 10 g/l. For agricultural needs of the Bukhara region, 4.1-4.3 billion m^3 of water resources are used annually. Every year, 2.1 billion m^3 of water is withdrawn from the irrigated areas of the region with the help of collector-drainage systems [12, 18, 19, 20,21].

Results and Discussion

The purpose of the research was to study the groundwater level of Bukhara region, the level of which is 1.0-2.0 m, the mineralization is 3.0-5.0 g/l. optimizing food regimes through phytomeliorative measures to save river water used to irrigate major agricultural crops and leach saline soils, increase the efficiency of 1 hectare of irrigated land, prevent environmental pollution and assess water resources management at the level of water consumers' associations (SIUs) and farms; improvement. To achieve the objectives of the study, the following research was conducted: Study of the natural and economic conditions of Bukhara region; study of soil conditions (type, mechanical composition, structure, water-physical properties, reclamation condition and fertility) of the test site; study of the effect of cultivation of White Oats (Sorghum Moench) as a phytomeliorant plant on the water-physical properties, salinity and nutrient regimes of soils prone to salinization; determination of norms and timing of soil saline leaching in areas where phytomeliorant plants are grown.

The research method

Field, laboratory research and phenological observations “Methods of field experiments” of the Research Institute of Cotton Breeding, Seed Production and Agrotechnology (UzPITI, 2007) performed on the basis of the accepted social research methodology. The accuracy and reliability of the obtained data were analyzed mathematically and statistically using the generally accepted multivariate method of BA Dospekhov and the computer program SPSS (Statistical Package for Social Science).

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Scientific novelty of the research

For the first time in order to adapt to climate change: Bukhara region groundwater level 1.0-2.0 m, mineralization 3.0-5.0 g/l meadow-alluvial, medium sand in terms of mechanical composition, moderately saline soils The effectiveness of phytomeliorative measures in obtaining high and high-quality crops, saving river water used for irrigation and salinization of soils, ensuring a favorable reclamation regime on irrigated lands, increasing the efficiency of 1 hectare of irrigated land, prevention of environmental pollution.

Experiments on the order of irrigation and its effect on the reclamation of the soil, the order of saline leaching were carried out in the following system.

Table 1. Experimental scheme for studying the effect of white corn as a phytomeliorant on soil reclamation and saline leaching regime

Options	Name of the event	
1	As a phyto-ameliorant crop after winter wheat - White corn (Sorgo) is planted.	the soil is washed with saline until the chlorine content reaches 0.01%
2	plowed after autumn wheat, the crop is not planted (control).	the soil is washed with saline until the chlorine content reaches 0.01%

Botanical description: White sorghum genus Sorghum Moench (pers) 4 cultivars: fodder, technical, food-grown white oats - S. Vulganell Pers, Kokand white oats - S. Cernum Host, Gaolyan (Japanese white oats) - S.chinensi, grass from water grown as a fodder crop - S.Sudanensi is widespread. The root is a poplar root that grows 2 meters deep into the soil and spreads up to 90 cm around. The length of the stem is 2.5-3.5 meters, in tropical countries it reaches 6-7 meters. The leaves are covered with broad tufted dust, each bush has 10-25 or more. The ball flower is a spike, with two spikes at the end of each branch of the spike. White oats are mainly pollinated from the outside. The grains are peeled and unpeeled, round, ovoid, white-brown, yellow-brown, the weight of 1000 grains is 25-40 g. Each stalk contains 1600 to 3500 grains.

White corn is the most arid plant, with a transpiration coefficient of close to 200, making it one of the most heat-resistant cereals. White corn seeds germinate well at soil temperature 12^0S-14^0S. Young and mature plants are absolutely resistant to frost. Air temperature can also rise at 35^0S-40^0S. A useful temperature sum of 2250^0S-2500^0S is required from seed sowing to ripening. Light-demanding, short-day plant. Yields high in sunny areas with low cloud cover. The transpiration coefficient of white corn is lower than that of other cereals. Because the roots penetrate deep into the soil, they use the moisture available in the soil and are not demanding to

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moisture.

Water-physical properties of experimental field soils. The volumetric weight of the soil at the beginning of the growing season was 1.29 g/cm^3 in the driving layer (0-30 cm), 1.36 g/cm^3 in the subsoil (30-50 cm), 1 in the 0-100 cm layer, Was equal to 35 g/cm^3. At the beginning of the growing season, the water permeability of the soil in the general background was 829.9 m^3/ha or 0.231 mm/min for 6 hours, but by the end of the growing season, Option 1 of the experiment or 0.203 mm/min. In the experiment, it was observed that the water permeability of the soil in the plowed and uncultivated control field was 764.7 m^3/ha, which is 6.7 m^3/ha more than in option 1. The limited field moisture capacity of the experimental field soil is 20.7-21.1% of the soil weight in the experimental years in the 0-100 cm layer, which is typical for meadow soils with average mechanical sand content.

Phytomeliorant - Irrigation regime of white oats (sorgo). Phytomeliorant plant White oats (sorghum), 820-960 m^3/ha irrigation norms and 2620-2880 m^3/ha seasonal irrigation norms according to the 1-1-1 irrigation scheme when soil moisture before irrigation is 70-80-65% of the limited field moisture capacity watered with. Irrigations were carried out from August to the end of September, the interval between irrigations was 22 - 25 days.

The effect of phytomeliorant plant on the salt regime of the soil. At the beginning of the growing season, the amount of chlorine in the soil was 0.017% in the 0-40 cm layer and 0.016% in the 0-100 cm layer. At the end of the growing season, the amount of chlorine in the soil increased by 0.015% in the 0-40 cm layer and 0.012% in the 0-100 cm layer, while in the arable field this value increased by 0.073% and 0-100 cm in the 0-40 cm layer. was found to increase by 0.071% in the stratum.

Growth and development of phytomeliorant plant. In experiments, White corn was fully germinated on July 6-9. In August, the height of white corn was 25.5-26.8 cm, the number of leaves was 8.7-9.3, while in September these figures were 150-165 cm and 11.6-12.1 grains. In the first ten days of September, White Oats entered the ripening phase and fully ripened on the 20th. In October, the height of white corn was 215-235 cm and the number of leaves was 15-16. During the experiments, 45.9-49.1 t/ha of white oats and 216-234 t/ha of white corn stalks were harvested from white oats due to the fact that they were very suitable for repeated crops, warm and dry, without precipitation and fed and irrigated during the required period.

Study the saline wash routine. Depending on the amount of salts in the soil, the type of salinity and the mechanical composition of the soil, as well as the specific climatic characteristics of the area, saline leaching criteria were determined. The salinity was measured using a Chipoletti water meter. In calculating the norm of saline leaching was calculated according to the following formula of V.Volobuev for one meter of soil layer, taking

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into account the water-physical properties of the soil and the amount of salts [3]:

$$N = 10000 * lg * [Si/Sadm]^{\alpha} \quad (m^3/ha).$$

Here: α - free salt transfer coefficient, Si, Sadm - the amount of salts in the soil before saline leaching and, in% of weight.

The high salinity leaching rate in the experimental field was recorded in the plowed control variant of the experimental field, in which the seasonal saline leaching rate was 5146-5227 m^3/ha. During the season, saline washing was carried out 3 times. In the 1st variant planted with white oats (sorghum), the saline leaching rate was 2754-2965 m^3/ha, and 2392-2262 m^3/ha less water was used than in the control variant.

Conclusions

Based on the analysis of the results of research work to reduce water consumption in saline leaching of lands through the application of phytomeliorative measures in Bukhara region, the following conclusions can be drawn:

1. The intensity of salt restoration at the end of the growing season was lower than in the control (plowed) variant in the planted version of the experimental field phytomeliorant plant. At the end of the growing season, the amount of chlorine in the soil in the variant planted with white oats increased from 0.016% to 0.032% in the 0-100 cm layer, while in the uncultivated field it increased from 0.016% to 0.086%. The salt accumulation coefficient in terms of chloride ion was 2.0 in the field planted with white corn and 5.38 in the field not plowed.

2. During the experiments, 45.9-49.1 t/ha of white oats and 216-234 t/ha of white corn stalks were harvested from white oats due to the fact that they were very suitable for repeated crops, warm and dry, without precipitation and fed and irrigated during the required period.

3. When carrying out saline leaching in the experimental field, the highest saline leaching rate was observed in plowed and uncultivated fields, with an average of 5146-5227 m^3/ha of water consumed per year. low, averaging 2754-2965 m^3/ha in three years.

References

1. Mirziyoyev Sh.M. “Concept for the development of the water economy of the Republic of Uzbekistan for 2020 – 2030”. // No. UP-6024 dated July 10, 2020.
2. Hamidov, A., Khamidov, M., Ishchanov, J. “Impact of climate change on groundwater management in the northwestern part of Uzbekistan// Agronomy. 2020
3. Khamidov, M.K., Khamraev, K.S., Isabaev, K.T. “Innovative soil leaching technology: A case study from Bukhara region of Uzbekistan” // IOP Conference Series: Earth and Environmental Science, 2020, 422(1), 012118.
4. Hamidov, A., Kasymov, U., Salokhiddinov, A., Khamidov, M. “Transformation in common-pool resources management in Central Asia how can intentionality and path dependence explain change in water-

management institutions in Uzbekistan? // International Journal of the Commons, 2020, 14(1), c. 16-29.

5. Khamidov, M.K., Balla, D., Hamidov, A.M., Juraev, U.A. “Using collector-drainage water in saline and arid irrigation areas for adaptation to climate change” // IOP Conference Series: Earth and Environmental Science. 2020, 422(1), 012121.
6. Ergashev, S, Bekmirzaeva. I. “Manual on irrigation and land reclamation and agricultural methods with minimal use of water resources in drought areas” // Tashkent: 2012. -7 p.
7. Hamidov, A. “Phytomelioration of saline soils. Proceedings of the International Scientific Conference "Modern Problems of Land Reclamation and Technical Development of Water Resources of the Republic of Uzbekistan" // Tashkent, 2008. - pp. 78-79.
8. Khamidov, M., Khamraev, K. “Water-saving irrigation technologies for cotton in the conditions of global climate change and lack of water resources // IOP Conference Series: Materials Science and Engineering, 2020, 883(1), 012077.
9. Khamidov, M.X., Suvanov, B.U., Juraev, U.A. “Recommendation for the development of recommendations for reducing water consumption in soil salinization through the use of phytomeliorative measures”// Bukhara, 2011, 1-28-p.
10. Hamidov, A., Beltrao, J., Costa, C., Khaydarova, V., Sharipova, S. “Environmentally useful technique - Portulaca oleracea golden purslane as a salt removal speciesWSEAS Transactions on Environment and Development” // 2007, 3(7), стр. 117–122.
11. Juraev, U.A., Khamidov. M.Kh. “Collection of articles of the international scientific-practical conference” //“Influence of phytoremediation plants on soil salts Innovative technologies in water management complex”. Ukraine., Rovno-2012. - p. 32-34.
12. Khamidov, M., Khamraev, K., Azizov, S., Akhmedjanova, G. “Water saving technology for leaching salinity of irrigated lands: A case study from Bukhara region of Uzbekistan” // Journal of Critical Reviews, 2020, 7(1), p. 499-509.
13. Khamidov, M., Isabaev, K., Urazbaev, I.,Islamov, U., Inamov, A., Mamatkulov Z. “Application of geoinformation technologies for sustainable use of water resources” // European Journal of Molecular and Clinical Medicine. Volume 7, Issue 2, September 2020, pages 1639-1648.
14. Urazbaev, I., Kasimbetova, S.,Akhmedjanova, G., Soniyazova, Z.“Development of agrotechnical methods and application of biomeliorant plants in the lower areas of Amudarya” //European Journal of Molecular and Clinical Medicine. Volume 7, Issue 2, September 2020, pages 844-849.
15. Khamidov, M.Kh., Isabaev, K.T., Urazbaev, I.K., Islomov, U.P.,Inamov, A.N.“Hydromodule of irrigated land of the southern districts of the republic of Karakalpakstan using the geographical information system creation of regional maps” //European Journal of Molecular and Clinical Medicine. Volume 7, Issue 2, September 2020, pages 1649-1657.
16. Matyakubov, B. “How efficient irrigation can ensure water supply in the Lower Amudarya basin of Uzbekistan” // 2003. International Water and Irrigation, 23 (3), pp. 26-27.
17. Matyakubov, B., Begmatov, I., Raimova, I., Teplova, G. “Factors for the efficient use of water distribution facilities” // CONMECHYDRO - 2020, IOP Conf. Series: Materials Science and Engineering 883 (2020)

012050 doi:10.1088/1757-899X/883/1/012050.

18. Matyakubov, B., Begmatov, I., Mamataliev, A., Botirov, S., Khayitova, M. “Condition of irrigation and drainage systems in the Khorezm region and recommendations for their improvement” // Journal of Critical Reviews, ISSN- 2394-5125, Volume 7, Issue 5, 2020, - p. 417 - 421.
19. Rahmatov, M., Matyakubov, B., Berdiev, M. “Maintainability of a self-pressurized closed irrigation network”// IOP Conference Series: Materials Science and Engineering, 1030 (2021) 012170 IOP Publishing doi:10.1088/1757-899X/1030/1/012170.
20. Avlakulov, M., Matyakubov, B., Isabaev, K., Azizov, S., Malikov E. “The limited problem of less parameters and the configuration of the depression curveat unreliable water filtration in soils”//Annals of the Romanian Society for Cell Biology, 2021, 25(1), p. 4538-4544.
21. Gafurov F.,KattakulovF.,Nazaraliev D., Gafurov Z. “Spatial and Temporal Analysis of Precipitation and Mapping using Terra Climate data in southern Uzbekistan” // (2020). International Journal of Recent Technology and Engineer.
22. Bekmirzaev, G., Beltrao, J., Neves, M.A., Costa, C. “Climatical changes effects on the potential capacity of salt removing species” // Int. J. Geol. 2011, 3(5), 79-85.
23. Bekmirzaev, G.,Ouddane, B.,Beltrao, J. “Effect of irrigation water regimes on yield of Tetragoniatetragonioides. Agriculture” // 2019, 9(1), 22. doi.org/10.3390/agriculture9010022.
24. Bekmirzaev, G.,Ouddane, B.,Beltrao, J.,Fujii, Y. “The Impact of Salt Concentration on the Mineral Nutrition of Tetragoniatetragonioides” // Agriculture, 2020, 10(6), 238. doi.org/10.3390/agriculture10060238.