EFFECT OF BIOSOLVENT COMPOUND ON SOIL SALINITY LEACHING PROCESS

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Annotatsiya: Ushbu maqolada tuproq sho‘r yuvish jarayonida Biosolvent birikmasini qo‘llab sho‘r yuvish texnologiyasini takomillashtirish bo‘yicha olib borilgan tadqiqot natijalari keltirilgan.

Kalit so‘zlar: qishloq xo‘jaligi, tuproq, sho‘rlanganlik darajasi, Biosolvent birikmasi, sho‘r yuvish, sug‘orish me’yori, iqtisodiy samaradorlik.

Abstract: This paper presents results of experiments conducted on soil salinity process with using Biosolvent compound in order to improve salinity leaching technology.

Key words: agriculture, soil, salinity degree, Biosolvent compound, soil leaching process, irrigation regime, cost-efficiency.

Today in the world there are about 1 billion hectares of arid and saline areas, which account for 25-30 percent of the land use. Of the 275 million hectares of irrigated land, 45 million hectares are occupied by saline and saline-prone soils, while saline areas account for 62 million hectares worldwide. In 75 countries of the world, mainly located in arid (arid) regions, the problem of salinity has taken a serious toll (Australia, China, India, Mexico, Pakistan, the United States, etc.). The yield of exactly 32 million hectares of land is directly affected by the salts contained in the soil. This leads to a decrease in the yield of agricultural crops.

There are a number of measures to improve the reclamation of irrigated lands,

including phytomelioration (improving land reclamation by planting saline-resistant (halophyte) crops), biomelioration (fertilizing, growing alfalfa), chemical reclamation, electricity (permanent electric tillage of the soil) and hydraulic reclamation (removal of salts from the soil by ditches and salt washing) [1-9].

A number of scientists from the USA, England and Australia [10] have conducted extensive research on the formation of soil salinization, as well as on combating this problem, i.e. on improving land reclamation based on a number of agro-reclamation measures. Mohammad Zaman et al. [11] argue that in order to combat salinization, it is necessary to develop a salinization control strategy that will prevent the spread of salinization and reduce the impact of salinization in the future. To achieve this goal, a number of measures were recommended, in particular, the cultivation of deep-rooted plants in areas with water scarcity, the correction of LGW through drainage and the washing of saline soils.

Based on the results of scientific studies conducted by Chinese scientists Yuzhi Zhang, Ruishan Chen and Yao Wang [12] in 1998-2015 on trends in improving land reclamation in the coastal areas of Shanghai using the ArcGIS program and the InVEST model, taking into account the successes achieved in the development of the coastal zone and contradictions in environmental policy, it was decided to take measures to improve and assess the land reclamation state, it was noted that today at the level of the government of the Chinese state a tough policy is being pursued with respect to the use of innovative ideas in restoring the land reclamation state necessary to respond to the work done earlier and prepare to the future.

Scientific research works were conducted in Bukhara region, 1.5-2.0 meters ground water level, alluvial meadow, moderately saline, mechanical composition performed on medium sandy soils.

In the option 1 of the experiment to determine the effectiveness of saline leaching, soil salinity leaching was carried out at a rate determined on the basis of V.R. Volobuev’s formula. In the variant 2 of the study, using a Biosolvent compound, the saline wash was performed at a rate 30% lower than the saline wash standard determined using V.R. Volobuev’s formula. In the variant 3 of the

experiment, the traditional method, i.e., the leaching rate was performed on the basis of actual measurements.

Classification of Biosolvent compounds. The Biosolvent compound was created by scientists of the Research Institute of Bioorganic Chemistry named after O. Sodikov under the Academy of Sciences of the Republic of Uzbekistan. Substances that make up the Biosolvent compound have a biopharming property and are fully compliant with the requirements for bio-degradable substances. Biosolvent is a polymer (polyanion) with a molecular mass of 2000–5000 Daltons. It ensures that the salts in the soil dissolve easily and quickly in water and is harmless to the soil and plant. The compound decomposes under the influence of the external environment, i.e. sunlight, rain and snow. And also salinity leaching with polymaleic acid, such as SperSal 35, Stop-Sal, NON SAL, recommended among the preparations for saline soils [13].

Experimental results on soil saline leaching based on Biosolvent compound. Periodic experiments conducted in 2017–2019 took into account the amount of salts in the soil (chlorine ion, sulfate ion and dry residue), the type of salinity, its mechanical composition and the specific natural and climatic indicators of the region. In determining the rate of saline leaching, the water-physical properties of the soil were calculated by the following formula of V.R. Volobuev on one meter of soil layer (formula 1):

$$N_{s.s.l.n.} = 10000 \cdot lg\left(\frac{S_i}{S_{adm}}\right)^{\alpha}, \quad cbm{\cdot}ha^{-1}, \qquad (1)$$

Note: Here: a - free salt transfer coefficient, S_i, S_{adm} - salts in the soil before saline leaching and the specified amount, in% of weight.

Comparing the three-year average results, it was found that the saline leaching rate was the highest in control option 3, using Biosolvent compound, and consumed an average of 1514 cbm·ha^{-1} more water than in saline wash option 2. During the experiments, the lowest water consumption for saline washing was observed in option 2, the average seasonal saline leaching rate was 2499 cbm·ha^{-1}, or water

resources were saved by 30% compared to option 1, 38% compared to option 3 (Figure 1).

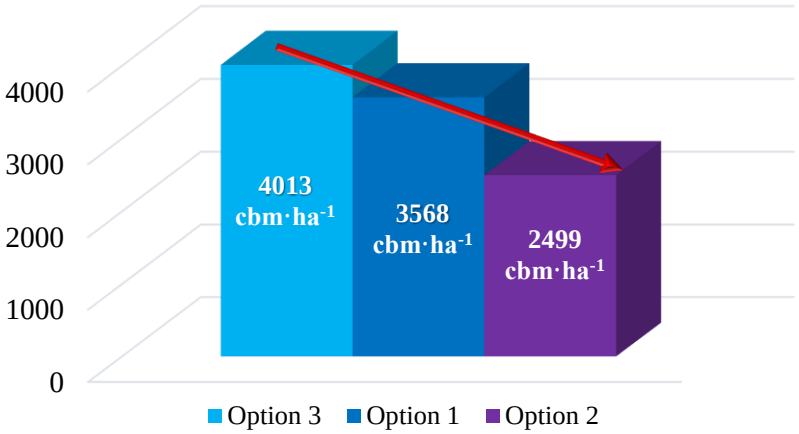

Figure 1. Soil salinity leaching norms in the experimental field (average 3 years).

Influence of irrigation regime on cotton yield. Data on the yield of the Bukhara-102 cotton variety in the experimental cotton cultivated in the research field in 2017-2019 shows that in control option 1, an average of 138.0 cbm of river water was used to grow 1 quintal of cotton and a yield of 36.6 cwt·ha^{-1}. In the second option, when the soil moisture before irrigation was 70-80-65% relative to LFMC, 84.3 cbm of river water was used on cultivation 1 quintal of cotton, and the total yield of cotton was 40.5 t·ha^{-1}. According to the results of the study, scientifically based pre-irrigation soil moisture is maintained at 70–80–65% relative to the LFMC, with an additional not only 3.9 quintals of cotton per hectare of Bukhara-102 variety of cotton, but also 1 quantial of cotton allowed to save 53.7 cbm of river water.

Cost-effectiveness of soil salinity leaching and holding cotton irrigation process with using Biosolvent compound. In determining the economic efficiency of medium-fiber cotton Bukhara-102, the cost of all agro-technical measures was calculated according to the approved technological map for the region, including pumping water for irrigation, as well as the cost of Biosolvent and its application.

Irrigation of saline soils with Biosolvent and irrigation of cotton with pre-irrigation of soil moisture by 70-80-65% compared to LFMC, ie additional cost of 533.3 thousand soums compared to the control option, increased the yield of cotton

by 3.9 t·ha^{-1}, and an additional net profit of 453.6 thousand sums was achieved, amounting to 2525.7 thousand soums. The level of profitability was 32.0%, which is 3.6% higher than the control.

On the basis of research on the impact of water-saving technology of saline soil leaching on soil reclamation and cotton yields in the conditions of meadow-alluvial, moderately saline and medium sandy soils of Bukhara oasis groundwater level of 1.5–2.0 m and mineralization of 1–3 g / l, the following conclusions were done:

1. During the researches, the lowest water consumption for leaching soil salinity was observed on using Biosolvent compound, the average seasonal saline leaching norm was 2499 cbm·ha^{-1}, or 38% of river water was saved compared to salt leaching in the control option.

5. Irrigation of saline soils with Biosolvent and irrigation of cotton with pre-irrigation of soil moisture by 70-80-65% compared to LFMC, additional cost of 533.3 thousand soums compared to the control option, increased the yield of cotton by 3.9 t·ha^{-1}, 1 quantial of cotton allowed to save 53.7 cbm of river water and an additional net profit of 453.6 thousand sums was achieved, amounting to 2525.7 thousand sums. The level of profitability was 32.0%, which is 3.6% higher than the control.

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