Annals of R.S.C.B., ISSN:1583-6258, Vol. 25, Issue 4, 2021, Pages. 5117 - 5136
Received 05 March 2021; Accepted 01 April 2021.

Technology for Mitigating Negative Consequences of Water Scarcity and Salination in Arid Regions by Phytomelioration Measures

[1]Mukhammadkhan Khamidov, [2]Umid Juraev, [2]Anvar Juraev, [2]Kamol Khamraev, [1]Shakhnoza Khamidova

[1]Tashkent Institute of Irrigation and Agricultural Mechanization Engineers, Tashkent, Uzbekistan.
E-mail: Khamidov_m@mail.ru
[2]Tashkent Institute of Irrigation and Agricultural Mechanization Engineers Bukhara Branch, Bukhara, Uzbekistan.
E-mail: khamraev0045@gmail.com

Abstract: The article presents the results of scientific research on water scarcity in Uzbekistan in recent years, ways to reduce its negative consequences, sustainable and high yields in years and regions with acute water scarcity, and reducing the use of phytomeliorant plants to improve land reclamation. It was also noted that after the harvest of winter wheat in conditions of water scarcity, the amount of salts in the soil decreased compared to the field without plowing, as a result of the cultivation of Carthamus tinctorius and Sorghum Moench pers from drought-resistant phytomeliorant plants and salt-resistant phytomeliorant plants, saline leaching standards were used less than 1509-2336 m^3/ha compared to the plowed field, and 99.5-273.6 t/ha of grain and hay were obtained from secondary phytomeliorant plants.

Keywords: Replanting; Carthamus tinctorius; Sorghum Moench pers; soil salinity; groundwater; saline leaching rate; growth; yield; groundwater mineralization; soil moisture; volume weight; irrigation rate; chlorine- ion; dry residue.

Introduction

Today, one of the biggest global problems in the world community is the shortage of freshwater resources. We see that the demand for freshwater resources has increased 8 times over the past 60 years. In many countries, water resources are also included in the list of imported products. Therefore, freshwater

Annals of R.S.C.B., ISSN:1583-6258, Vol. 25, Issue 4, 2021, Pages. 5117 - 5136
Received 05 March 2021; Accepted 01 April 2021.

resources are one of the limited resources in the whole world community, and today there are a number of problems in the distribution of these resources between countries [21].

About 90% of the irrigated lands in the Bukhara region are saline territories of various levels, and an average of 4.2-4.6 billion m^3 of river water is used annually for irrigation and saline leaching of these territories. In addition, 1.9-2.2 billion m^3 of underground water is discharged from the region through collector and drainage networks. Such discharged groundwater is mainly groundwater generated by the absorption of river water used for irrigation [22].

From the experience of countries around the world it is known that in conditions of water shortage, high efficiency can be achieved as a result of the widespread introduction of water-saving irrigation technologies. In conditions of water shortage, it becomes possible to improve the reclamation situation as a result of cultivating drought-tolerant and salt-tolerant phytomeliorant plants, as well as saving river water by 15-20%.

Scientific research on the creation of additional water sources to mitigate water scarcity, reduce the salt content in the soil using salt-absorbing plants, improve land reclamation using reclamation measures in the field of agriculture, in particular in the field of irrigation due to climatic, reclamation, geological and environmental conditions was carried out by leader scientists, including: K.M.Mirzajonov, A.Avliyakulov, G.A.Bezborodov, M.H.Khamidov, J.Axmedov, X.Sheraliev, B.Matyakubov, D.D.Umarova, A.T.Jumanazarov, N.E.Malaboev, A.M.Khamidov, L.Stepanova, D.Balla, S.Maasen, and others [19, 20].

Experiments conducted in the conditions of the Syrdarya region have shown that when washing medium and strong saline soils with water containing 1-3 g/l of salt, the soil can be washed and leached the rest with river water until the salt contained in the same water remains. In the composition 1-3 g/l of salt collector and a little salt accumulates in the soil, going to late autumn, when watering the

Annals of R.S.C.B., ISSN:1583-6258, Vol. 25, Issue 4, 2021, Pages. 5117 - 5136
Received 05 March 2021; Accepted 01 April 2021.

husks, corn and autumn Willow. But in late autumn, winter and early spring crops do not need water, and during these periods it is possible to leach the accumulated salt with water to 1,5-2,5 thousand m^3/ha [1].

The C.album galophyte plant, which is characteristic of the Khorezm region, can be recommended to those climates as a large-scale salt-absorbing and highly biomass-giving plant. This plant can be widely used in pharmaceutical industry as raw material; A.lancifolium and Kcaspia galophyte plants can be used as a fodder base for salt cultivation and livestock breeding; research has been carried out to put the plants into the exchanging planting system, and after phytomelioration, abundant and qualitative harvest can be obtained from cotton, hemp, corn and other crops. Studies of developed countries have shown that Tetragonia tetragonioides and Atriplex prostrate plants have the ability to absorb salt up to 700 kg/ha and 1000 kg/ha and give a high biomass [3].

In the CBSPCARI experiments of N.I.Kurileva and S.Asimov [4] in Bukhara, when alfalfa was planted on feed and seeds, chlorine ions in the soil were initially 0.018% in the 0-100 sm layer, 0.016% in the 100-200 sm layer, and 0.018% in the 200-300 sm layer. After 1 year, the seasonal accumulation of salt increased in the autumn period, and by year 3, the number of chloride ions was 0.009% in the 0-100 sm layer, 0.066% in the 100-200 sm layer and 0.0079% in the 200-300 sm layer and the water-physical properties of the soil are improving. In the following years, 46 cwt/ha of cotton was collected, and in the second year - 45 cwt/ha.

When Mirzajonov and others [5] determined the effect of soil salinization of the alternating planting system of the CBSPCARI in Fergana, chlorine ion in the soil layer of 0-50 sm in the 3-year alfalfa field decreased from 0,013% to 0,009%, while SO_4 decreased from 0,290% to 0,154%, and dry residue from 0,635% to 0,301%. In the 0-100 sm layer of soil, it was found that the amount of chlorine ion decreased from 0,012% to 0,010%, the amount of SO_4 from 0,358% to 0,296%, and the amount of dry residue from 0,759% to 0,541%.

Annals of R.S.C.B., ISSN:1583-6258, Vol. 25, Issue 4, 2021, Pages. 5117 - 5136
Received 05 March 2021; Accepted 01 April 2021.

When Kh.M.Mirzajonov and others [5] determined the effect of soil salinization of the alternating planting system in Fergana, chlorine ion in the soil layer of 0-50 sm in the 3-year alfalfa field decreased from 0,013% to 0,009%, while SO_4 decreased from 0,290% to 0,154%, and dry residue from 0,635% to 0,301%. In the 0-100 sm layer of soil, it was found that the amount of chlorine ion decreased from 0,012% to 0,010%, the amount of SO_4 from 0,358% to 0,296%, and the amount of dry residue from 0,759% to 0,541%.

In the experiments of Sheraliev.X and others [6] on the cultivation of various hybrids of corn in the meadows of Tashkent with mechanical sand, sandy soils with 1.5-2.0 m of groundwater in depth after winter wheat in the soil at a depth of 27-28 sm from the annual norm of nitrogen fertilizers 40% were used during the 4-5 leaf crop period and the rest (60%) during the 8-9 leaf crop period. In the conducted scientific studies, irrigation took soil moisture at the level of 75-80-70% relative to LFMC, which ensured high top-dressing yield of maize.

In the research conducted by Nurbekov A.I., [7] it was determined that the yield of the “Durdona” variety of mung bean, which was planted in the field free from the wheat crop in the conditions of Kashkadarya region of Uzbekistan without soil tillage, was more than 1.94 cwt/ha or 0.33 cwt/ha when planted in the soil tillage. In experiments carried out in the Hisar valley of the Republic of Tajikistan, it was found that when sowing the “Tajik-1” variety of mung bean as a re-crop using the new technology, the yield increases by 2.37 cwt /ha and 0.76 cwt/ha compared to the traditional technology, sowing seeds of re-crops without tillage, preserving plant residues, the chemical composition increases, it was noticed that the placement of mid-season varieties of African millet as a re-crop makes it possible to develop animal husbandry and promote the cultivation of abundant forage crops.

Dzhumanazarova A.T. [8], conducted scientific research on growing corn for hay in the northern regions of the Republic of Karakalpakstan, during which corn was irrigated 5 times during the growing season, and an increase in seasonal

Annals of R.S.C.B., ISSN:1583-6258, Vol. 25, Issue 4, 2021, Pages. 5117 - 5136
Received 05 March 2021; Accepted 01 April 2021.

irrigation rates provided an increase in corn hay, and the corn yield was achieved from 570 to 605 cwt/ha during the 4650 m^3/ha irrigation norm.

Materials and Methods

Materials and Methods should be described with sufficient details to allow others to replicate and build on published results. Please note that publication of your manuscript implicates that you must make all materials, data, computer code, and protocols associated with the publication available to readers. Please disclose at the submission stage any restrictions on the availability of materials or information. New methods and protocols should be described in detail while well-established methods can be briefly described and appropriately cited.

Field, laboratory research and phenological observations on cotton breeding, growing seeds of agricultural technologies Research Institute “methods of conducting field experiments” (UzPITI 2007), the international DIN and ZALF standard of agricultural technologies Research Institute of agricultural technologies according to the methods adopted in laboratory conditions the amount of salts Switzerland was developed by the metpohm-858 detector and SPECORD-200, soil moisture in the field, the total amount of salts emitted by the UGT-ump-1 detector, the total amount of salt in groundwater, temperature, conductivity and pH of the water were determined using the German instrument Multi 3620 IDS SET G, Multi 3410 SET 7, calibration water levels were determined using a German SEBAROMROMETRIA instrument. Also, when growing biomeliorant plants, “the methodology of field experiments with grain crops” (1971) and “the methodology of the State variety cultivation of agricultural crops” (M.Kolos, 1964), “recommendations on the scientific foundations of cultivating autumn crops” (Bukhara, 1998) were carried out on the basis of methodological recommendations.

Annals of R.S.C.B., ISSN:1583-6258, Vol. 25, Issue 4, 2021, Pages. 5117 - 5136
Received 05 March 2021; Accepted 01 April 2021.

The accuracy and reliability of the obtained data were analyzed using the generally accepted multifactor method of B.A.Dospekhov, as well as the computer program SPSS (Statistical Package for Social Science)[12].

Research work on the use of phytomeliorative measures was carried out on the fields of meadow-alluvial, moderately saline, gray-gray water levels of the "Bafo Kurban Sarkor" farm in the Bukhara district of the Bukhara region with a depth of 1.5-2.0 meters. After a fall in the field, field experiments were carried out scientific research to improve the reclamation state of the land through the cultivation of phytomeliorant plants, as well as reducing the norms and terms of leaching salts (table 1).

The research works were placed in one tier, in 3 repetitions, the area of each variant was 960 m^2 (length 100 m, width 9.6 m), the total area of the experiment was 8640 m^2. In the 1^{st} version of the experiments, the crop was plowed without sowing after winter wheat, and in the 2^{nd} version, the effect of planting Carthamus tinctorius and in the 3^{rd} version of Sorghum Moench pers plant was determined by the reclamation state of the soil.

At the beginning of the experiment to determine the salt regime of the soil in the studied field, soil samples are taken at a depth of 20 sm to ground water before and after each watering of phytomeliorant plants, as well as at the end of the growing season for each field and variants and then, the amount of dry residue and chlorine ion are determined. In addition, the degree of chlorine-ion leaching was determined when washing with salt solution in each variant (at a depth of 1 m). The amount of humus in the soil was determined by the I.V.Tyurin method, the total amount of nitrogen and phosphorus in the soil was determined by the method of L.P.Grisenko, I.M.Maltsev, the method of nitrate nitrogen calorimeter, the method of moving phosphorus of B.P.Machigin, the method of exchange of potassium P.V.Protasov. Phenological observations were determined by selecting 100 plants on the 1^{st}-3^{rd} day of each month. Also, the yield of phytomeliorant plants in all variants and the return in the phase of full

Annals of R.S.C.B., ISSN:1583-6258, Vol. 25, Issue 4, 2021, Pages. 5117 - 5136
Received 05 March 2021; Accepted 01 April 2021.

grain ripening were determined. In each variant, the plant was harvested by hand from 3 areas with each 1 meter sized, and the head of crops was crushed and weighed. The yield of hay was also determined by weighing. In determining the level and mineralization of groundwater, water samples were taken and analyzed under laboratory conditions before the start of the experiments and at the end of the growing season, as well as before each irrigation and 3-5 days after irrigation.

Table 1. Experimental scheme

Variants	Name of the activities to be conducted.	Name of the activities to be conducted.
1	A field that is not plowed and sown after winter wheat, (control).	leaching saline until chlorine content reaches 0.01%
2	Field planted with Carthamus tinctorius as a phytomeliorant crop after winter wheat.	leaching saline until chlorine content reaches 0.01%
3	Field planted with Sorghum Moench pers as a phytomeliorant crop after winter wheat.	leaching saline until chlorine content reaches 0.01%

Results and Discussion

Morphological structure of the soil of the experimental field. To study the morphological structure of the experimental field, a section of soil was dug in the field of the winter wheat farm "Bafo Kurbon Sarkor" in the Bukhara region, for which genetic layers were taken and soil samples were taken, which were analyzed in the laboratory.

The lithological structure of the soil, layer thickness, morphological features, humidity, density, and granularity were studied in the section of the soil. The

Annals of R.S.C.B., ISSN:1583-6258, Vol. 25, Issue 4, 2021, Pages. 5117 - 5136
Received 05 March 2021; Accepted 01 April 2021.

most important hydrophysical and agrochemical properties of the soil were also determined in the obtained soil sections. Data on soil sections is shown below (table 2):

Table 2. Soil characteristics on genetic layers

Layers (sm)	Morphological characteristics of the soil
An 0-28	surface layer, light gray, moderately sandy, dry, fertile, loamy soil, medium mechanical composition, plant debris and roots are found.
Ann 29-58	subsurface layer, consisting of agroirrigation deposits, is gray in color, moderately sandy, the moisture level is higher than in the upper layer, significantly denser, and the roots of wheat roots and perennial weeds are found.
B1 59-132	agroirrigation deposits are inconspicuous, dark gray, with yellowish-spotted streaks, moderately compacted, scattered carbonate and coarse sand grains where wheat roots and perennial weed root remnants occur.
B2 133-168	brown, high moisture level, light sand, fine grain, carbonate and sand grains spread
C1 169-214	yellowish - brown, strongly moistened, medium sandy, granular, compacted small layer (1.5 - 3 sm) gypsum, carbonate streaks, high humidity and groundwater accumulated in the lower layer.

Mechanical composition of the soil of the experimental area. The mechanical composition of the soil was assessed according to the classification of N.A.Kachinsky. Before planting phytomeliorant plants, water-physical properties of the soil were studied. The experimental field soil consists of medium-grained soils of 0-95 sm and light-grained soils of 96-135 sm according to the classification of N.A.Kachinsky [13, 17].

Agrochemical properties of experimental field soil. When the change in the amount of humus contained in the soil before planting phytomeliorant crops (table 1) was analyzed, the amount of humus in the layer (0-30 sm) was an average of 1,222 mg/kg, in the subsurface layer (30-50 sm) was 1,076 mg/kg, and in the 1-meter layer the amount of humus was 0,920 mg/kg, in the 2nd variant, where the plant was planted, the amount of humus in the tillage layer of the soil was 0,117 mg/kg higher than the control field and amounted to 1,335 mg/kg. In the 3rd variant, where white corn was planted, the amount of humus in the tillage layer of the soil was controlled, was 0.150 mg/kg higher than in the plow field, and amounted to 1,368 mg/kg.

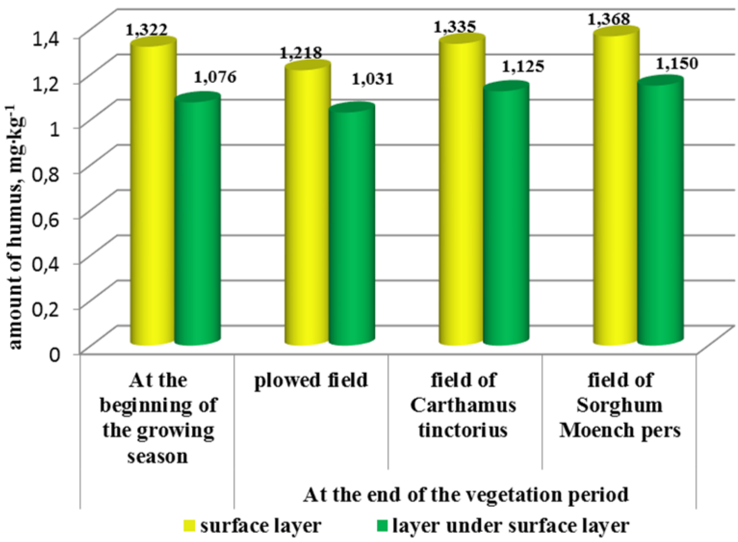

Figure 1. The changes in the amount of humus in the soil.

Effect of phytomeliorant plants on the bulk density of the soil. The bulk density of the soil was 1.30 g/sm^3 in the 0-30 sm layer, while the surface layer was 1.32 g/ sm^3 in the 30-50 sm layer under the surface layer, the bulk density of the soil in the 0-100 sm layer was equal to 1.35 g/ sm^3. By the end of the experiments, in the control variant, that is, in the field of plowing, the bulk density of the soil was equal to 1.30 g/ sm^3 in the plowed layer, in the 1-meter layer increased to 0.01 g/ sm^3 compared to the beginning of the vegetation

Annals of R.S.C.B., ISSN:1583-6258, Vol. 25, Issue 4, 2021, Pages. 5117 - 5136
Received 05 March 2021; Accepted 01 April 2021.

period, and it was equal to 1.36 g/ sm^3. The bulk density of the soil in the variant planted Carthamus tinctorius as a phytomeliorant plant was 1.32, respectively; on 1.36 g/ sm^3, while on the field where white corn was planted, it was less than 0.01 g/ sm^3 compared to the control variant, and 1.30; was equal to 1.35 g/ sm^3.

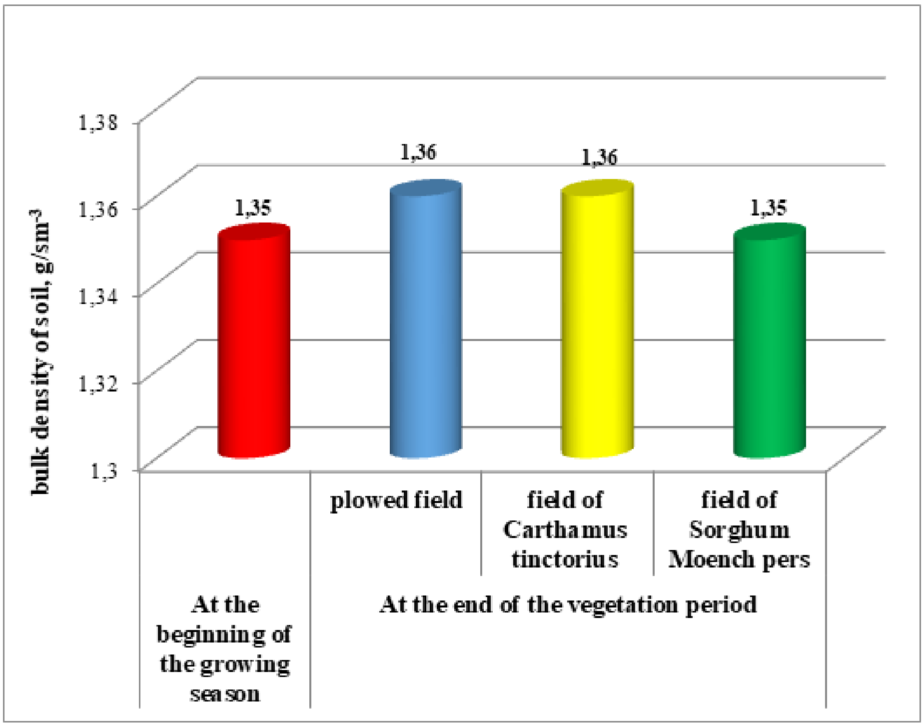

Figure 2. The effect of phytomeliorant plants on the bulk density of the soil.

Irrigation norm of phytomeliorant plants. Experiments were conducted on winter wheat stalk. When studying irrigation procedures, the criteria, timing and number of each irrigation norm, as well as the criteria for seasonal irrigation, depending on the established soil moisture and climatic parameters was determined [14, 15, 16]. When calculating the irrigation norm, the formula of S.N.Rijov [9] was used to calculate the amount of soil moisture, which is determined taking into account the water-physical properties of the soil and the depth of moisture:

$$m=100 * h * J * (W_{LFMC} - W_{AM}) + K \quad m^3/ha \qquad (1)$$

here: W_{LFMC} - the limited field moisture capacity relative to bulk density, %;

W_{AM} - the actual moisture before irrigation relative to bulk density, %;

J - the bulk density of the soil, g/ sm^3;

h - the calculated layer value, m;

K - the water consumption for evaporation in irrigation, m^3/ha (10% of the moisture capacity in the calculated layer).

Irrigation of phytomeliorant plants in the experimental area was carried out on the basis of the system adopted in the work program. In this case, the watering periods and irrigation norms for the variants were determined based on the soil moisture content.

Irrigation scheme during the growing season for irrigation of phytomeliorant plants when the soil pre – irrigation moisture was 70-80-65% relative to LFMC in the variant planted Sorghum Moench pers, the irrigation scheme was 1-1-1, irrigation norm - 853-933 m^3/ha and seasonal irrigation norm-3859 m^3/ha. For the Carthamus tinctorius, 0-1-1, irrigation norm was 887-921 m^3/ha, seasonal irrigation norm was 2974 m^3/ha, or irrigation norm for the Sorghum Moench pers was 885 m^3/ha less than the planted variant (table 3).

Table 3. Irrigation regime of phytomeliorant plants

Variants	**Plant types**	**Number and norm of irrigation,** m^3**/ha**				**Irrigation scheme**	**Seasonal irrigation norm,** m^3**/ha**
		1	**2**	**3**	**4**		
Average in 2010-2012							
1	Plowed field	-	-	-	-	-	-
2	Carthamus tinctorius	1166	921	887		0-1-1	2974
3	Sorghum Moench pers	1166	907	933	853	1-1-1	3859

Annals of R.S.C.B., ISSN:1583-6258, Vol. 25, Issue 4, 2021, Pages. 5117 - 5136
Received 05 March 2021; Accepted 01 April 2021.

Influence of phytomeliorant plants on soil salt regime. In order to study the dynamics of salts in the experimental areas of Carthamus tinctorius and Sorghum Moench pers planted as phytomeliorant, samples were taken every 10 sm in the 0-100 sm layer of soil and the amount of salts (CL, SO_4, HCO_3, dry residue) adversely affecting plant growth and development was analyzed in the laboratory.

In experiments, at the beginning of the growing season, the amount of chlorine in the 0-40 sm layer of soil was 0.019%, and in the 0-100 sm layer - 0.016% and at the end of the experiments, in variant 2, where the Carthamus tinctorius crop was planted, its content increased to 0.027% in the tillage layer (0-40 sm), while in the 0-100 sm layer the chlorine content in the soil increased to 0.025% to 0.041%.

In the third variant of our research, that is, in the field where white corn was planted, the amount of chlorine ion in the soil increased by 0.017% in the 0-40 sm layer, it was equal to 0.032% in the 0-100 sm layer. In our control field without plowing and sowing, we could see that the amount of chlorine in the soil increased by 0.031% in the 0-40 sm layer and by 0.052% in the 0-100 sm layer, the amount of chlorine in the 0-100 sm layer increased by 0.048% compared to the beginning of the growing season.

The control variant, that is, in a field without plowing, where evaporation from the surface layer of the soil was higher than in other options, due to the fact that the water contained in the groundwater, the salinity of the soil was higher than in other options as a result of the addition of salts, entering the surface layer of the soil.

Annals of R.S.C.B., ISSN:1583-6258, Vol. 25, Issue 4, 2021, Pages. 5117 - 5136
Received 05 March 2021; Accepted 01 April 2021.

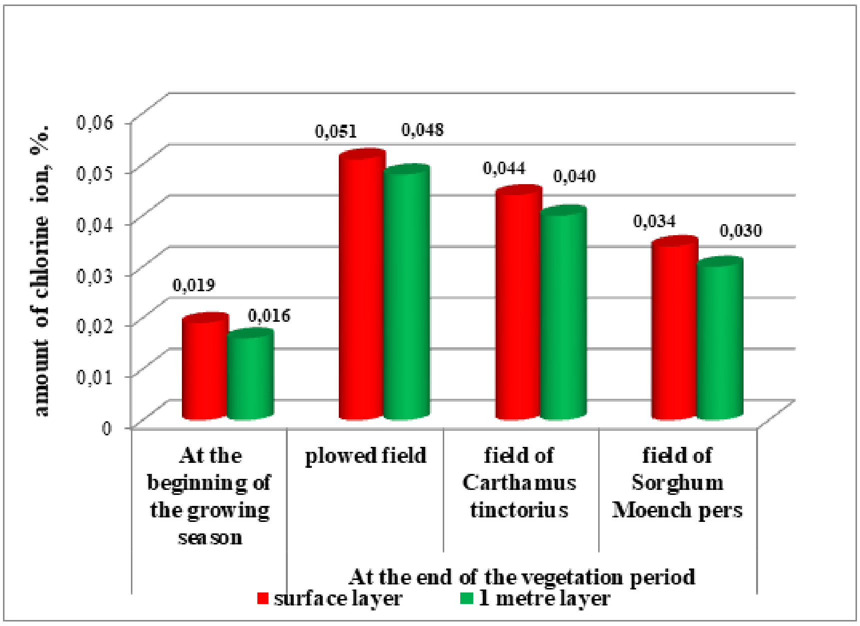

Figure 3. Effect of phytomeliorant plants on the amount of chloride ion in the soil.

When the study examined the effect of phytomeliorant plants on the amount of dry residue in the soil, it was found that by the end of the growing season, a field sown with Sorghum Moench pers collected less dry residue than in other variants. The control showed that the amount of dry residue in the untreated field increased by 0.316%, which corresponds to 0.483%, in the 0-100 sm layer. In the variant with Carthamus tinctorius seeding, the amount of collected dry residue was 0.183% lower than the control one and amounted to 0.300%. In the variant with white oats, the content of dry residues in the soil by the end of vegetation was 0.244%, which is 0.239% less than in the control variant.

Annals of R.S.C.B., ISSN:1583-6258, Vol. 25, Issue 4, 2021, Pages. 5117 - 5136
Received 05 March 2021; Accepted 01 April 2021.

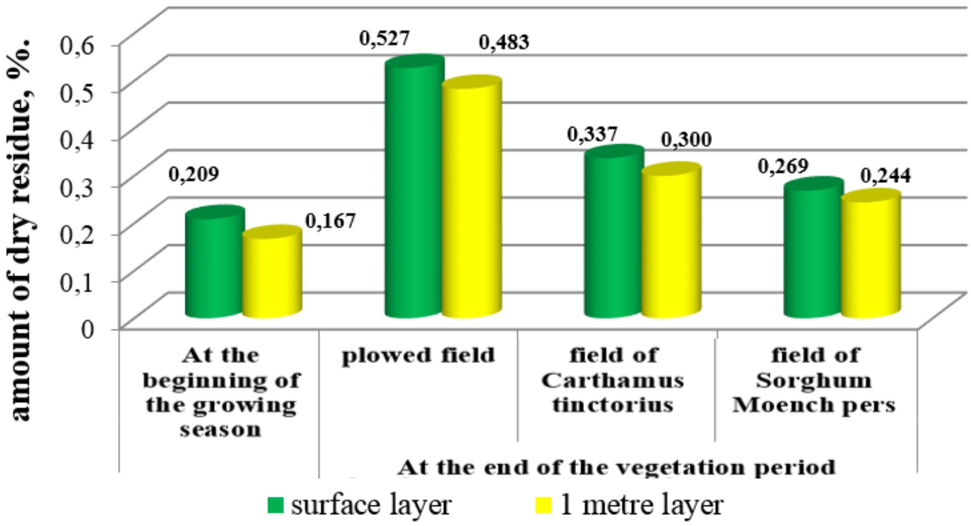

Figure 4. Changes in the amount of dry residue in the soil.

In conclusion, when sowing Carthamus tinctorius and Sorghum Moench pers as a phytomeliorant after a fall in the experimental field, insufficient evaporation from the soil surface occurs, irrigation with phytomeliorant plants reduces the rise of saline mud water from the soil capillaries, thereby reducing the recovery of salts in the soil in comparison with the field left without treatment, thereby increasing the efficiency of using 1 ha of irrigated land.

Leaching of saline soil. After the phytomeliorant plants were harvested, saline leaching was carried out. In saline leaching, the field was plowed to a depth of 35-40 sm and prepared for saline leaching. At the end of the growing season in the experimental field to perform saline leaching in the field of scientific research, the amount of salts in the soil and the mechanical composition of the soil, the specific climatic parameters of the region were determined. In calculating the salinity leaching rate, one meter of soil layer was calculated according to the following formula of V.R.Volobuev, taking into account the water-physical properties of the soil and the amount of salts [10, 13,18]:

$$N = 10000*\lg*[\, S_i/S_{adm} \,]\alpha \quad (m^3/ha) \qquad (2)$$

Here: α – coefficient of free salt transfer, S_i , S_{adm} – saline leaching of salts in the soil and the allowable amount, in% of weight.

Annals of R.S.C.B., ISSN:1583-6258, Vol. 25, Issue 4, 2021, Pages. 5117 - 5136
Received 05 March 2021; Accepted 01 April 2021.

In the field of experiment, the highest standard of salt leaching is noted in the field of the control variant, in which the area is plowed, in this variant the seasonal salt leaching machine was carried out on average 5187 m^3/ha in 2010-2012, and in the field of salt leaching 3 times during the season. In the 2nd variant, where the Carthamus tinctorius plant was planted, the seasonal salinity norm was 3638 m^3/ha and less water was consumed than 1549 m^3/ha compared to the control option. If during the season 2 times the washing of salt was carried out in the Carthamus tinctorius field, then in the 3rd variant, where Sorghum Moench pers was planted, the norm of salt leaching was 2852 m^3/ha and control, water was spent 2335 m^3/ha less than in the field of plow (table 4).

Table 4. Salt leaching procedure in the experimental field

Variants	**Indicators**	**Salt leaching, m^3/ha**			**The rate of seasonal saline wash, m3/ha**
		1st salt leaching	**2nd salt leaching**	**3rd salt leaching**	
Average in 2010-2012					
Plowed field	rate of saline wash, m3/ha	2268	1504	1415	5187
Carthamus tinctorius	rate of saline wash, m3/ha	2152	1486		3638
Sorghum Moench pers	rate of saline wash, m3/ha	2852			2852

In the course of the research, salt leaching activities continued from the 2nd decade of December to the last decade of January, the period between watering was 14-18 days. The highest rate of salt leaching was observed after autumn, when plowing was observed on an untreated field, and the minimum rate of salt leaching was observed in the variant where Sorghum Moench pers was planted as a phytomeliorant.

Conclusions

About 90% of the irrigated areas of the Bukhara region are saline at different levels, on average, 4.2-4.6 billion m^3 of river water is consumed for irrigation and washing of salts in these areas. In addition, 1.9-2.2 billion m^3 of groundwater is discharged from the territory of irrigated areas through collector-drainage networks. This released groundwater constitutes groundwater, which is mainly formed by the absorption of water used for irrigation into ground.

If the change in the humus content in the soil before sowing phytomeliorant plants after harvesting winter wheat in conditions of water shortage was 1.32 mg/kg in the middle layer and 1.076 mg/kg in the subsurface, by the end of the growing season, the humus content in the soil was 1218 mg/kg in the control field, which is 0.117 mg/kg higher than in the control field in the field planted with Carthamus tinctorius, and 1335 mg/kg. In a field where Sorghum Moench pers were planted, it was 0.150 mg/kg higher than in a plowed field, at 1368 mg/kg.

If the bulk density of the soil was 1.35 g/ sm^3 in the 0-100 sm layer at the beginning of the growing season, then by the end of the growing season, the control variant increased by 0.01 g/sm^3 to 1.36 g/ sm^3. In the variants sown with Carthamus tinctorius and Sorghum Moench pers, the bulk density of the soil was 1.36 and 1.35 g/sm^3, respectively.

In order to obtain a high yields from phytomeliorant plants and reduce the accumulation of salt in the soil, during the vegetation period, Sorghum Moench pers were irrigated with irrigation norms up to 753-65 m^3/ha in the 1-1-1 scheme, while retaining moisture at 853-9 m^3/ha with 70-80-65% relative to the LFMC and seasonal irrigation norms up to 3859 m^3/ha. Carthamus tinctorius, however,

Annals of R.S.C.B., ISSN:1583-6258, Vol. 25, Issue 4, 2021, Pages. 5117 - 5136
Received 05 March 2021; Accepted 01 April 2021.

was irrigated on 0-1-1 scheme with irrigation norms of 921-887 m^3/ha and seasonal irrigation norms of 2974 m^3/ha.

When studying the effect of phytomeliorant plants on the salt regime of the soil, initially, at the beginning of the growing season, the amount of chlorine in the 0-40 sm layer of soil was 0.019%, and in the 0-100 sm layer 0.016%, by the end of the experiments, the plowed, uncultivated control field was 0.051% and 0.048%, respectively. In the 2nd variant planted with Carthamus tinctorius, these figures increased to 0.044% and 0.040%, and in the 3rd variant planted with Sorghum Moench pers, to 0.034% and 0.030%. Similar indicators were observed for dry residue in the soil: 0.483% in the 0-100 sm layer in the control variant, 0.337% in the Carthamus tinctorius planted field and 0.244% in the Sorghum Moench pers planted variant, and phytomeliorant plants were found to reduce salt accumulation in the soil.

In the field conditions of the experiment, the highest rate of salt leaching was noted in the control variant, where the experiment was plowed up in the field. In this variant, the seasonal saline solution averaged 5187 m^3/ha, and during the season, 3 times more saline solution was applied in the field. In the second variant, where the Carthamus tinctorius was planted, the rate of seasonal salt washing was 3638 m^3/ha; during the season, salt leaching was carried out 2 times. In this variant, less water was used by 1549 m^3/ha compared to the control variant. In the third variant, where Sorghum Moench pers was planted, the rate of salt leaching was 2852 m^3/ha, and the water consumption was less by 2335 m^3/ha compared to the control variant.

In areas where water scarcity is, in order to reduce its negative consequences strongly felt, improve the state of land reclamation, obtain a stable and additional agricultural harvest after the fall harvest, rather than to leave the plowed field without sowing, the efficiency of irrigated land as a result of the cultivation of resistant phytomeliorant plants - as a result of the optimization of its physical properties, the saving of water resources is created, which is spent for salt leaching activities.

References

1. Mirzajonov V. M. From the history of the Uzbek cotton research Institute in the field of land reclamation//UzSPCA, CBSPCARI, ICARDA. Tashkent, 2009. Pages 11-15.
2. Shodmonov Yu., Isaev S. Prospects for irrigation of cotton with mineralized waters -//Scientific conference September 3, 1999, CBSPCARI. Tashkent, 2001, pp. 166-168.
3. Hamidov, A., Khamidov, M., Ishchanov, J. Impact of climate change on groundwater management in the northwestern part of Uzbekistan.Agronomy, 2020, 10(8), 1173.
4. Kuryleva N.I. Azimov S., Alfalfa meliorant - a nutritious plant//International Scientific Conference on Atomic Energy PSUEAITI. Tashkent, 2003, pp. 114-15.
5. Mirzajonov Kh.M. Wind erosion of irrigated soils of Uzbekistan and measures to combat it // “Fan” Publishing House, Tashkent, 1973, 213, 233 pages.
6. Sheraliev X. et al., Irrigation of winter grain crops // Tashkent: 2003. p.60.
7. Nurbekov A.I. Cultivation of agricultural crops based on resource-efficient agriculture in the irrigated conditions of Central Asia.//Doctoral dissertation. Tashkent, 2018, p. 26.
8. Djumanazarova A.T. Improvement of corn irrigation with livestock wastewater in the conditions of the Republic of Karakalpakstan // Abstract of the thesis for the scientific steppe candidate of agricultural sciences, Tashkent., 2011, p-19.
9. Ryzhov S.N. On the methods of determining the timing of watering cotton - // Tashkent, publishing house: Academy of Sciences of the UzSSR, 1953, p-189. 1.
10. 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.

11. Hamidov, A.; Beltrao, J.; Costa, C.; Khaydarova, V.; Sharipova, Sh. (2007) Environmentally useful technique - Portulaca Oleracea golden purslane as a salt removal species. WSEAS Transactions on Environment and Development 3 (7), 117–122.
12. Khamidov, M., Matyakubov, B., Isabaev, K. Substantiation of cotton irrigation regime on meadow-alluvial soils of the Khorezm oasis. Journal of Critical Reviews, 2020, 7(4), с. 347-353.
13. 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), с. 499-509.
14. Balla, D., Omar, M., Maassen, S., Hamidov, A., Khamidov, M. Efficiency of duckweed (Lemnaceae) for the desalination and treatment of agricultural drainage water in detention reservoirs. Environmental Science and Engineering (Subseries: Environmental Science), 2014, (202979), с. 423-440.
15. Khamidov, M., Muratov, A. Effectiveness of rainwater irrigation in agricultural crops in the context of water resources. IOP Conference Series: Materials Science and Engineering, 2021, 1030(1), 012130
16. 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, 2020, 7(2), стр. 1649–1657
17. Khamidov, M., Isabaev, K., Urazbaev, I., ...Inamov, A., Mamatkulov, Z. Application of geoinformation technologies for sustainable use of water resources. European Journal of Molecular and Clinical Medicine, 2020, 7(2), pp. 1639–1648
18. 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

19.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.

20.Begmatov, I.A., Matyakubov, B.Sh., Akhmatov, D.E., Pulatova, M.V. Analysis of saline land and determination of the level of salinity of irrigated lands with use of the geographic information system technologies// InterCarto. InterGIS GI SUPPORT OF SUSTAINABLE DEVELOPMENT OF TERRITORIES Proceedings of the International conference. Volume 26 (2020), part 3- p. 309 - 316.

21.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.

22.Imamnazarov, O.B., Pulatova, M.M., Khayitova, M.S., Azizov, Sh, N., Malikov, E.N., Qurbonov, K.M. “Ground water modes regulation during irrigation by the water-saving method”// Journal of Critical Reviews, 2020, 7(12), стр. 924–927.

23. Fakhriddin Abdikarimov, Kuralbay Navruzov. Mathematical method of calculating the volume of the cavities of the heart ventricles according to echocardiography. European Journal of Molecular & Clinical Medicine, 2020, Volume 7, Issue 8, pp. 1427-1431.

24. Fakhriddin Abdikarimov, Kuralbay Navruzov. Mathematic modeling of pulsation movement of blood in large arteries. European Journal of Molecular & Clinical Medicine, 2020, Volume 7, Issue 8, pp.1438-1444.

25. Fakhriddin Abdikarimov, Kuralbay Navruzov. Determining hydraulic resistance of stationary flow of blood in vessels with permeable walls. Annals of the Romanian Society for Cell Biology, 2021, 25(3), pp. 7316–7322.

26. Fakhriddin Abdikarimov, Kuralbay Navruzov. Modern Biomechanical Research in the Field of Cardiology. Annals of the Romanian Society for Cell Biology, 2021, 25(1), pp. 6674–6681.