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Monitoring of the Process of Changes of the Surface of Underground Waters and Level of Salinity in Farms of Syrdarya Region

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Abstract
This article is devoted to the theoretical and practical aspects of monitoring on the basis of data obtained as a result of the analysis of the Syrdarya Regional Melioration Service in the reclamation state of irrigated soils, the collection of data collected on the groundwater level and salinity in recent years (2018-2019), a detailed study of the reclamation state of the soils of the territory. The authors emphasize the need to establish information support in the formation of a monitoring system for irrigated lands, the need to develop a local monitoring structure using observational data from the Syrdarya Regional Land Reclamation Service to achieve this goal. In order to use irrigation water economically in conditions of water scarcity, it was mentioned that the critical (acceptable) depth of groundwater should be determined based on the mineralization of groundwater (salinity level).

Keywords: Land and water resources, reclamation measures, collector, drainage, underground waters, salinity, toxic salts, salt reserves, monitoring.

Introduction

In order to ensure the implementation of the Decree of the Cabinet of Ministers of the Republic of Uzbekistan “On additional measures to improve the reclamation of irrigated lands and ensure the unconditional implementation of the state program on the rational use of water resources in the period 2017-2021”, a number of agromeliorative measures are being implemented in order to increase

The rational use of land and water resources in irrigated areas, constant control over the reclamation state of saline areas and regular improvement of the yield and quality of the resulting crop of agricultural crops by timely implementation of agromeliorative measures are considered topical issues of today. From this, it is necessary to carry out all agrotechnical and reclamation activities in places correctly and on time, and for this, by studying and re-taxalizing soil properties, its reclamation-ecological state, to develop scientifically based proposals and recommendations [1].

Object, purpose of the research and methods

In order to monitor the reclamation of irrigated soils of the Syrdarya region located in the low plains of foothills and its rational use, research work is being carried out.

In order to monitor the reclamation of the soil in the irrigated areas of the regional farms, the employees of the Syrdarya Reclamation Expedition and the data collected by ourselves were analyzed. In this, field experiments and laboratory methods were used.

There are a total of 287,175,000 hectares of irrigated land controlled by Syrdarya Reclamation Expedition in the region, of which, as of October 1, 2018, soil samples from constant dynamic points were extracted, and the amount of chlorine ion was determined by the consumption of silver nitrate, as well as by the indication of the X-express and by the indicator of conduct meter device. Soil samples were taken from layers of 0-0.3 m, 0.3-0.7 m, 0.7-1.0 meters.

Main body

It is known that the efficient and rational use of land and water resources in irrigated areas, restoration and maintenance of soil fertility, regular increase in the yield of agricultural crops are today’s current problems. Therefore, it is necessary to carry out various agrotechnical and reclamation activities in places

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correctly and on time, and for this to carry out detailed monitoring of soil properties, its reclamation-ecological state, to develop scientifically based proposals and recommendations based on the obtained data [2,3].

There are total 287,175 m.ha of irrigated area in the region, and groundwater drainage networks of length of 15,962.25 km are serving to take out underground waters, of which 7,593.38 km are open drainages and 8,368. 87 km are closed drainages. 1948.24 km of open drainages are inter-farm drainages and 55645.14 km are farm internal ditches.

The main collectors of the region carrying underground waters are: they are MMZ, Shuruzak, GPK, Sherbuloksoy, GPK-42s, SK-2, SK-3, SK-6, SK-7, 17-K-7, Bayaut, Yettisoy, Kendik, VS-13, VJD, Sardoba.

The irrigated areas are fully drained, the length of the Collector-drainage networks corresponding to an area of 1 ha consists of 56.32 running meter.

The volume of groundwater, carried out from irrigated land using collector-drainage networks, was monitored by measuring every ten days. The chlorine and dry residual content in collectors and irrigation network waters was determined and controlled by chemical analysis once a month.

In 2018 in the region the volume of underground water consisted of 7,667.40 m^3/ha and module of subsurface water consisted of 0.24 l/sec/ha from 1 hectare released through collector-drainage network.

In 2019, compared to 2018, 275,50 million m^3 more water was taken for irrigation. As every year in 2019, during the irrigation period 213.35 million m^3 water was taken by farmers from open collectors for irrigation by temporary pumps.

If we estimate the average salinity level of collector waters, the average salinity of collector waters also changed compared to last year as a result of the decrease in the flow of water coming out through collector-drainage networks in 2019, that is, in 2018 the average salinity of collector waters was 3.68 g/l on dry residue and by chlorine it consisted of 0.25 g/l. On the released salts indicator it showed the decrease of 651.13 on dry residue and on chlorine 109,28 tons compared to 2018.

The main reasons for these changes are the growing number of fish farms in the districts and the flowing waters from them, which are being thrown directly into collector networks, in addition to the fact that internal irrigation networks have not been repaired for many years and are falling directly into collector networks due to malfunctions. This of course leads to a decrease in the dry residue and chlorine indicator of the collector waters and a violation of the water–salt balance.

If we see the flow and salinity of groundwater by line of the districts, then outside the territory of the Bayaut district in 2019 through collectors were taken out 201.02 million m^3 water. The salinity level of collector waters was 3.20 g/l on dry residue and 0.21 g/l on chlorine. Module of subsurface waters consisted of 0.16 l/SEC/ha. The salts that flowed into the territory of the district were 727.29 thousand tons, the protruding salts were 643.26 thousand tons. The main reason for the abundance of incoming salts is the collector waters obtained from the internal irrigation network for irrigation through discharges and pumps that fall directly into the collector. 14.07 million m^3 of collector water was used for crop irrigation.

The flow of collector waters in Gulistan district in 2019 amounted to 282.04 million m^3. The salinity level of collector waters reached 2.17 g/l on dry residue and 0.15 g/l on chlorine. Module of subsurface water escape was 0.32 l/SEC/ha. 7.20 million m^3 of collector water was used for crop irrigation.

The flow of collector waters in the Mirzaabad district in 2019 amounted to 362.32 million m^3 ha. The salinity level of collector waters reached 2.80 g/l on dry residue and 0.35 g/l on chlorine. Module of subsurface waters escape was 0.27 l/SEC/ha. 16.01 million m^3 of collector water was used for crop irrigation.

In 2019 in Ak-Altyn district 289.67 million m^3 underground waters flowed out the territory of the district through collectors, level of salinity of those waters consisted 3.10 g/l on dry residue and 0.37 g/l on chlorine. The highest level of collector water mineralization is inextricably linked with the geomorphological conditions of the district. The module of subsurface waters escape was 0.23 l/SEC/ha. 4.3 million m^3 of collector water was used for crop irrigation.

In 2019 in Sardoba district, 107.99 million m^3 of underground water were taken out using collectors. The salinity level of collector waters was 3.32 g/l on dry residue and 0.41 g/l on chlorine. The module of subsurface escape was 0.08 l/sec/ha. 19.01 million m^3 of collector water was used for crop irrigation.

In 2019 in Saykhunabad district, 330.56 million m^3 underground water were taken out. The salinity level of collector waters was 2.21 g/l on dry residue and 0.16 g/l on chlorine. The salts that flowed into the territory of

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the district were 631.31 thousand tons, the protruding salts were 730.54 thousand tons. The module of subsurface escape was 0.31 l/sec/ha. 24.68 million m^3 of collector water was used for crop irrigation.

In 2019 in Syrdarya district, the volume of groundwater released through collectors was 277.03 million m^3, and it was found that the average salinity of water was equal to 2.28 g/l on dry residue and 0.18 g/l on chlorine. The volume of subsurface escape was 0.25 l/sec/ha. 102.90 million m^3 of collector water was used for crop irrigation.

In 2019 in Khavas district, the flow of collector waters amounted to 351.25 million m^3. The salinity level of collector waters was equal to 2.90 g/l on dry residue and 0.25 g/l on chlorine, 1018.61 m tons of salt were taken out from the territory of the district. The volume of subsurface escape was 0.29 l/sec/ha. 25.09 million/m^3 of collector water was used for crop irrigation. The water received for irrigation into the district was 347.18 million/m^3 and the ratio to the water released through the colector was 0.98 percent. The reason for the large release of water is the geomorphological conditions of the territory and the confluence of underground waters entering from the territory of Tajikistan.

As of January 1, 2019, the region has 1948.24 km of inter-farm drainage, it was found that 2165.51 kilometers of farm internal drainages, 5157.83 kilometers of closed drainages are in an unsatisfactory condition, and we believe that cleaning and repair work should be carried out taking into account this.

The reclamation state of irrigated lands and the degree of salinity of soils, in turn, are inextricably linked with the surface of underground waters, the degree of their salinity and movement, are constantly changing.

According to the information presented in the literature, surface of underground waters and its salinity largely depend on the technical condition of the subsurface escape networks and the amount of atmospheric precipitation, the supply of running water during the growing season and the movement of groundwater entering from the outside (1,3).

There are 2,057 observation wells for monitoring UWS (underground waters surface) and UWM (underground water mineralization) levels in the region, with data being obtained every ten days. On the district section (1:50000) on UWS and UWM levels (1: 50000) to the 1 April before the irrigation season, the 1 July date during the irrigation season, and the October 1 date when the irrigation season is over (1:100,000) scale maps are compiled.

According to 2019, the depth of the underground waters level and the level of underground waters mineralization show that the land reclamation status has improved compared to 2018. At the beginning of the growing season (April 1), the area of less than 2 meters was 111.74 thousand hectares, or 38.9%. In the 2018, this indicator was 49,5%. During this period, the mineralization of underground water was 93.65 thousand hectares, or 32.6%, with an area of up to 3 g/l (low salinity) on dry residue. In 147.95 thousand ha or 51.5% irrigated land, the underground waters depth was at a critical point above 2 meters, of which 2.31 thousand ha or 1.0% was a depth of up to 1 meter in irrigated land. The mineralization of underground waters was 193.22 thousand ha or 62.7% of the areas above 3 g/l (weak, medium and strongly saline). The area of less than 2 meters the underground water depth was reduced to 2.89 thousand hectares, the areas with a load of 3 g/l in terms of the level of mineralization increased by 11.44 thousand hectares.

At the end of the growing season (October 1), the area which is situated in the area where the depth of underground waters 2 meters increased to 3.78 thousand hectares, the level of mineralization of underground waters increased to 22.79 thousand hectares. The degree of mineralization of underground waters continued with changes throughout the year. The main reasons for this must be the conduct of irrigation work and a change in the level of underground waters.

If we analyze the data on January 1, 2020 in the reclamation point of irrigated lands of Syrdarya region, there are 287,175 thousand hectares of irrigated areas in the region, according to reclamation cadastre data, 8,613 thousand hectares are good in reclamation, 239,570 thousand hectares are satisfactory, 38,992 thousand hectares are unsatisfactory areas.

In 2018, it was identified that 9.12 thousand hectares were reclamation-good areas, in 2019 this indicator was 8.613 thousand hectares, reclamation-satisfactory area was 242.483 thousand hectares, by 2019 this indicator had reached 239.570 thousand hectares or decreased by 2.913 thousand hectares, reclamation-unsatisfactory area was 35.544 thousand hectares, while 2019 by the year, this indicator was 38,992,000 hectares, or increased to 3,448,000 hectares.

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According to the data obtained, it was found that in the region there are 8,613 thousand hectares of non-saline, 220,549 thousand hectares of low-saline, 49,839 thousand hectares of medium-saline and 8,174 thousand hectares of strongly saline areas.

The non-saline area by region decreased by 0.507 thousand hectares in 2019 compared to 2018, the less saline area increased by 1.380 thousand hectares, the middle saline area decreased by 3.705 thousand hectares, and the strongly saline area increased by 2.860 thousand hectares.

The fact that strongly saline areas increased mainly in Sardoba and Mirzaobod districts of the region, and these districts are prone to salinity, this is mainly due to the fact that in later times, fish farms were established and 68 percent of salinity work was carried out in practice in the areas where salt washing was to be carried out..

The categories of salinity of the lands have changed significantly in the areas where the saline works were carried out. The soil washing measures set for the 2019 harvest indicated 219,697 hectares of low-salinated, 53,248 hectares of medium-salinated, 5,321 hectares of strongly saline areas, with strongly salinated areas reduced by 750 hectares in soil-washed areas compared to the salinity categories of the lands on the 1 October 2018, and medium-salinated areas decreased by 1,760 hectares and low-salinated areas by 2,861 hectares.

Conclusion

Based on the data obtained, the main part of the irrigated areas of Syrdarya region is saline to varying degrees, which requires the implementation of appropriate agro-ameliorative measures in order to grow a high and high-quality crop from agricultural crops in these areas, depending on the level of groundwater and the degree of mineralization. At the same time, the main attention should be paid to the correct organization of irrigation work and ensuring the functioning of collector and ditch networks as normal. Alternatively taking into account the water shortage. In areas with a low level of underground waters mineralization during the vegetation period of plants, it will be advisable to revise the critical depth of the underground in order to effectively use the of underground waters.

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