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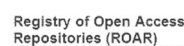
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2000 m³/ha of water. On hydromorphic lands (groundwater level 1,5 ÷ 2 m) and with a shallow layer of soil (0.5 ÷ 1 m) should not sand and pebble artificial soil moisture accumulation ratios exceed 1000 ÷ 1500 m³/ha. In our conditions, to determine the salt leaching standards V.R. Volobuev expedient to use the formula.

$$N = 10000 \cdot h \cdot \lg(S_n / S_d)^a \quad (11)$$

Here: N — leaching rates, m³/ha; h = capacity of the washed soil-ground layer, m; S_n — salt content in the layer is washed prior to washing (% of dry weight soil-ground); S_d — allowable salt content (% dry weight of soil-ground); a — salting rate determined according to experimental industrial washings. Significance soleotdachi depends on water-physical properties of soils and their changes for a variety of loam within the following limits:

- For light mechanical composition depending on the composition of salt — 0.62 (chloride — Cl=40–60%) — 0.82 (sodium sulfate);
- For the loamy soils of the inhomogeneous structure corresponds $a = 0.92$ (chloride type of salinity) — 1.12 (sodium sulfate-type);
- For clay or loam with low salting $a = 1.22$ (chloride type of salinity) — 1.42 (sodium sulfate), etc.

The formula for the calculation of V.R. Volobuev less salting land reduces the rate of salt leaching, thus it is advisable to salt leaching standards equate to the above regulations moisture accumulation.

In our conditions, the main method of combating soil salinity is to build on fields year-round washing mode.

$$K_p = \frac{O_p + N + O_c}{ET_c} = 1,1 \div 1,2 \quad (12)$$

CP is the coefficient of leaching regime of irrigation land is based on many years of advanced materials, on the recommendation should be $K_p = 1.1-1.2$.

In justifying modes and agricultural irrigation standards must take into account a variety of weather conditions and crop technology. To account for the changing weather conditions by way of watering crops as the main option, you must take the totality of precipitation in vegetation period. Calculation of one-time and seasonal irrigation standards for FAO methodology and program SROPWAT to evaluate the efficiency of water use in irrigation systems, water saving in the current and future level of development, water use criteria with a decrease in water supply, determine the exact water needs and water management features.

To determine the norms washing salinity V.R. Volobuev expedient to use the formula. In view of the above, the calculation of one-off and seasonal irrigation standards the same for all irrigated areas of FAO method and program CROPWAT should be used in the Republic of Uzbekistan respectively, adapting and making adjustments.

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Land meliorative status in irrigated lands of Syrdarya province

Abstract: Article describes the assessment results of land meliorative status in new improved complex approach in districts of Syrdarya province. Research was mostly conducted in the districts. Moreover, the recommendations for improvement of each district is presented.

Keywords: vegetation period, groundwater mineralization, soil salinization, irrigated lands, cadastre, land meliorative status, water supply, wells, closed horizontal drainage.

Introduction

In the region, initial studies on meliorative zoning conducted by V. N. Legostaev and B. S. Konkovin 1961 year. The research proposed a methodology that developed for designing meliorative activities. At that time there was less experience on different types of drainage to against land salinization and was not been using the methods of justification of meliorative activities based on water-salt balance.

A great contribution to the development of methods of engineer-meliorative zoning was done in the 1960s by A. A. Rachinskiy, who summarized the theoretical basis for the study of meliorative zoning based on water-salt balance that required for any meliorative project. However, these studies on meliorative zoning were aimed on meliorative projects of development of new agricultural lands.

Currently indicators of land melioration status cannot be separated from water supply, drainage and technical condition of hydromeliorative systems.

Maintenance of drainage network in operating condition — the basic requirement to ensure a drainage on lands where applicable horizontal drainage, and also in co-operation of this kind of drainage with others. An analysis of the technical condition of drainage network of Syrdarya province farms has shown that as the drainage's technical condition deteriorates, the area of medium — and strongly saline lands and lands with unacceptably high levels of ground water increase, which ultimately affects the productivity of crops.

The presidential decree of the Republic of Uzbekistan of April 29, 2012 “About measures for further improvement of irrigated land and the efficient use of water resources”, as well as the state program for development of the water sector for the period 2013–2017, require a deeper study, planning and implementation measures to improve meliorative condition of irrigated lands, as well as improving the scientific methodological basis of scientific studies, which leads to the relevance of the topic.

The literature on water balance calculations in the melioration, there is mainly addressed issues of drawing up balances in a season, a year, or for long time. In the present time when water and other natural resources are limited, it is necessary to a conduct more detailed researches on the regulation of water-salt balance of irrigated lands with time series, such as a month. This is necessary in the operation of hydromeliorative systems and in preparation of projects for improving the integration of natural and economic conditions of the object and establishing the optimum technical and economic parameters of hydromeliorative systems.

In modern practice, actual and forecasted water-salt balance are compiled for one or several territories, or for administrative areas. Due to the fact that the impact of drainage areas include roads, canals, settlements, the overall water balance necessary to be on the gross area of meliorated circuit. This allows to take into account the hydraulic relationship “big” and “small” drainage systems, to more accurately predict the depth of groundwater table and the load on drainage.

The purpose of this research is to carry out meliorative zoning of Syrdarya province, which allows to properly orient in planning of strategies of melioration work and the proof of their effectiveness.

Meliorative zoning for the first time carried out on existing hydromeliorative system, basing on the analysis of actual melioration regimes and recommended settings on the forward-looking terms, based on general and particular water-salt balance.

Study area

The area of research is located in the South Central part of the Open Steppe. According to the administrative division, the research

area relates to Sardoba, Havat, Mirzabad Bayaut, Gulistan, Sayhun, Syrdarya and Akaltyn District of Syrdarya province.

The total area Syrdarya province of 427600 hectares, where 298800 hectares is irrigated land. The main crops of the land are cotton (37% of the area) and wheat (30% of the area), with gross harvest of 250344 tons of cotton and 356318 tons of grain (in 2011).

Materials and methods

There has been developed the principles and methodology for meliorative zoning. There has been developed parameters for meliorative regimes for different hydrogeological-soil-meliorative and economic conditions, taking into account the use of resources of collector-drainage waters for irrigation. Achieved meliorative zoning of Syrdarya province on the complexity of melioration and drainage module with the appropriate parameters of recommended meliorative regimes. Additionally, there is refined methods of technical and economic comparison of different types of drainage, zoning map developed by type and size of drainage.

Results and discussion

During the vegetation period of 2011, groundwater depth are divided differently. Saykhunobod, Gulistan and Boyovut districts 1.5–2 m (45–85%), and 2–3 meters (7–51%) were in depth. Areas of Oq oltin, Sardoba, Havas, Mirzaabad and Syrdarya districts were 2–3 meters (62–92%) in depth (Figure 2).

When we analyze the distribution of groundwater mineralization areas, Saykhunobod, Syrdarya, Gulistan districts were 1–3 g/l (50–83%), Boyavut, Oqoltin, Havas, Mirzaabad districts were 3–5 g/l (55–80%), Sardoba district were 5–10 g/l (62%) (Figure 3)

At the end of the vegetation period in 2011, the soil salinity distribution in almost all districts were low saline (77–96%) and high saline (1–20%), and in Mirzabad district almost 50% of the land were medium salined (Figure 4).

Meliorative status of Bayaut, Sardoba, Oqoltin, Mirzaobod, Havas districts of Syrdarya provinces were very low (0–1,1%), poor areas were 8–23%.

Assessment of water supply for irrigated land during the vegetation period following formula were used [1].

$$B_3^{BII} \eta_c + B_{KDC} < K_B^{BII} [O_p]^{CB} \psi^{CB} \quad (1)$$

Where: B_3^{BII} — water sampling during the vegetation period m^3/ha ; η_c — Coefficient of irrigation systems; K_3^{BII} — A decrease in the average irrigation rate, in this case, the maximum yield of agricultural crops will decline by at least 10% in this case. According to “Guidebook”, K_3^{BII} — growing to an average of 0.80, while SANIIRI of the Academy of Sciences the end of the recycling that coefficient is 0.83; $[O_p]^{CB}$ — Irrigation water mineralization of 1 g/l, which is a significant case for the structure of agricultural real average rate m^3/ha ; ψ^{CB} — the status of land reclamation and irrigation account of increase in irrigation water was achieved a significant increase in the extent of the corrective coefficient average indicator.

$$[O_p]^{CB} = \frac{O_p^1 f_1 + O_p^2 f_2 + O_p^3 f_3 + \dots + O_p^n f_n}{\sum_{i=1}^n f_i}, m^3/ha \quad (2)$$

Here: $O_p^1, O_p^2, O_p^3, \dots$ — corresponding to the areas of gidromodul clear standards for agricultural irrigation, m^3/ha ; f_1, f_2, f_3 separate fields for crops, ha.

In case of water resources shortage and propensity to land salinization, the water availability of non-vegetation period should be calculated for (from November until April).

$$B_3^{MB} \eta + B_{KDB} < K_B^{MB} [B]_{MB}^{CC} \psi^{CC} \quad (3)$$

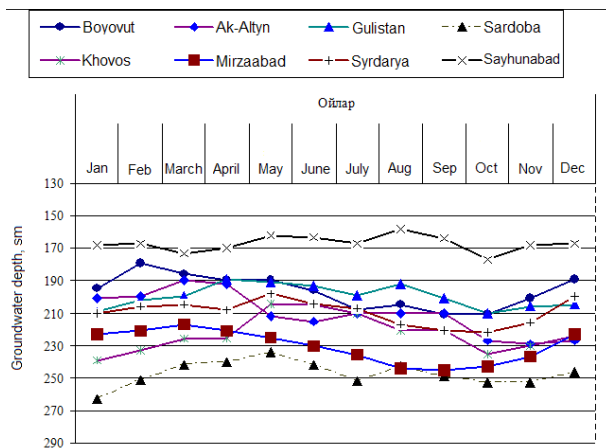


Figure 1. Groundwater depth by months

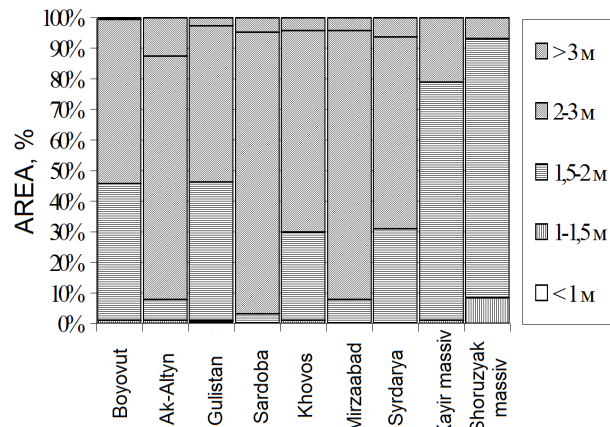


Figure 2. Groundwater depth during the vegetation period

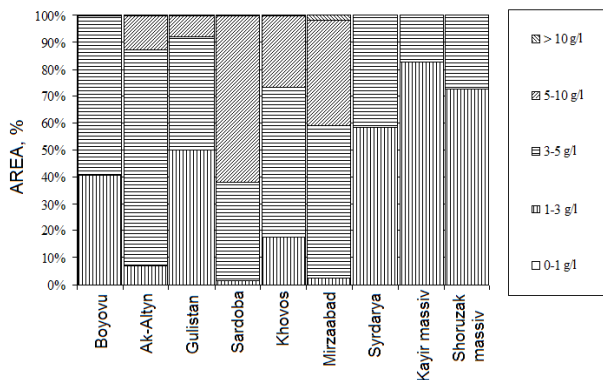


Figure 3. Groundwater mineralization during the vegetation period

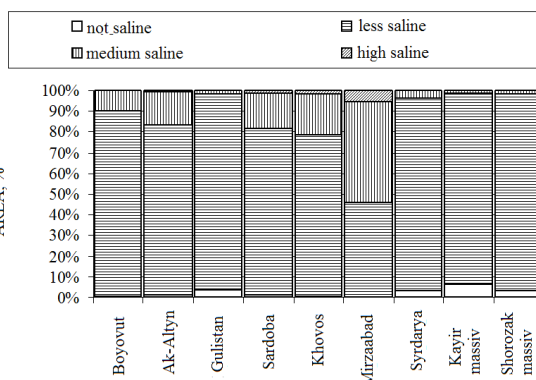


Figure 4. Soil salinity level at the end of vegetation period

In case of water resources shortage and propensity to land salinization, the water availability of non-vegetation period should be calculated for (from November until April).

$$B_3^{MB} \eta + B_{KIB} < K_B^{MB} [B_{MB}^{CC} \psi^{CC}] \quad (3)$$

Water demand for non-vegetation period:

$$[B^{MB}] = \sum_{i=S_0}^S \sum_{j=0}^F N_{ij} f_{ij} + \sum_{i=1}^n m_j^{B3} f_j^{B3} + O_p^{3sp} f_{3sp}, \text{ m}^3/\text{ha} \quad (4)$$

Here: $N_{ij} f_{ij}$ — leaching norm and area, m^3/ha ; i — level of soil salinity; j — soil texture; S, S_0 — initial and maximum level of soil salinity; m_j^{B3}, f_j^{B3} — leaching level and area according to soil texture, $O_p^{3sp} f_{3sp}$ — wheat irrigation norm and area in non-vegetation period; K_B^{MC} — coefficient of beforehand identification the

water supply. According to SANIIRI, this coefficient equal to $K_B^{MB} = 0,90$.

During the non-vegetation period the water use is not enough over the entire Syrdarya province (30–50%). In Ak-Altyn and Sardoba districts the water use was not enough during the vegetation period (70–76%), while in Sayhunabad district the water has been used more than enough (140%) and in other districts the water supply was sufficient.

Even in Syrdarya basin the water resources are enough, during the non-vegetation period the water use coefficient is very low. Causes of such not efficient use of water resources could be not proper actions during leaching also weakness of technics, fuel and labor.

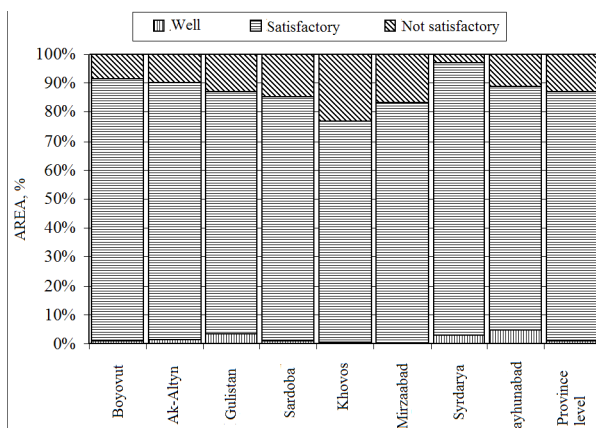
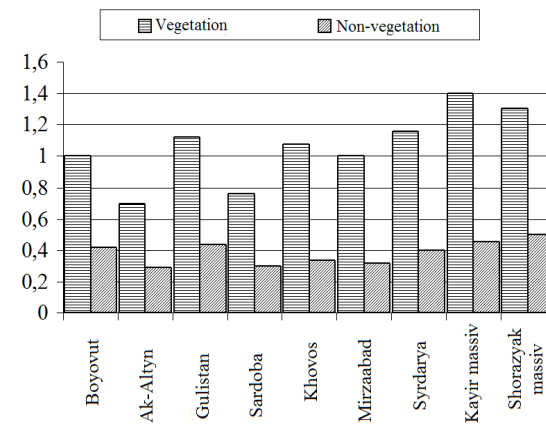


Figure 5. Meliorative status of land according to land cadaster



6. Coefficient of water use by districts

During the year in districts the leaching water supply was not sufficient level (0.77–1.09) (Figure 7) (According to SANIIRI rec-

ommendation should be 1.2–1.3). The coefficient of leaching water over the year can be calculated by using:

$$K = \frac{B_d + O_c + B_{kdc} + B_{bd} - C\delta_d}{ET_d} \quad (5)$$

Here: B_A — amount of irrigated water by canals, m^3/ha ; O_c — amount of rainfall, m^3/ha ; B_{kac} — irrigated drainage water, m^3/ha ; B_{ba} — irrigated well water, m^3/ha ; $C\delta_A$ — amount of drained water from area, m^3/ha ; ET_A — amount of evapotranspiration, m^3/ha ;

Ak-Altyn, Sardoba, Khovos, Mirzaabad districts of Syrdarya province mostly designed with closed drainage systems (46–77%), Gulistan, Syrdarya, Sayhunabad districts with open drainage systems (70–77%) and Boyovut district with vertical drainage systems (57%).

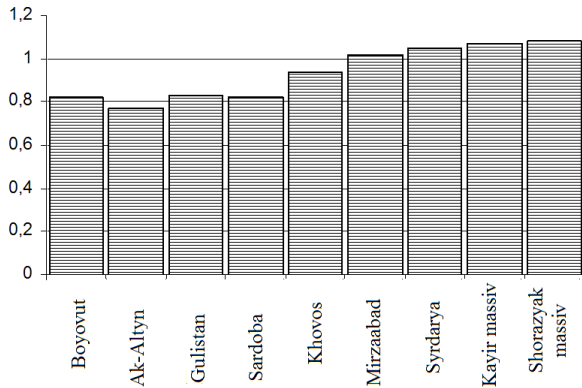


Figure 7. Regime of leaching

In 2011 the productivity of cotton and wheat was diverse. In Boyovut, Ak-Altyn, Gulistan, Syrdarya, Sayhunabad va Sardoba the cotton yield was 2,0–2,8 thousand kilogram per hectare and wheat crop was 4,7–5,4 thousand kilogram per hectare. Meanwhile, in

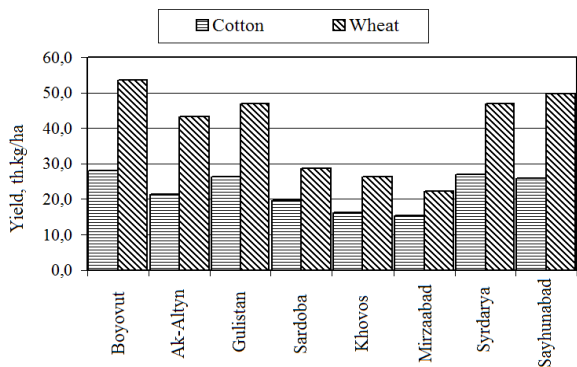


Figure 9. Cotton and wheat yields by districts

According to data on total water balance by districts the water resources divided variously to districts (10, 11, 12 – Figures)

Calculation of drainage level [1]

$$D_\phi = \frac{D_r + D_b}{B + O_c + \Phi_{mk} + \Pi - O - C} \quad (6)$$

Here: D_r — amount of drainage water from horizontal drainage, m^3/ha ; D_b — amount of drainage water from vertical drainage, m^3/ha ; B — amount of water provided for district, m^3/ha ; O_c — amount of precipitation, m^3/ha ; Φ_{mk} — amount of filtration from main canals, m^3/ha ; Π — amount of water came from underground, m^3/ha ; O — amount of water flowed from underground m^3/ha ; C — operational water use, m^3/ha ;

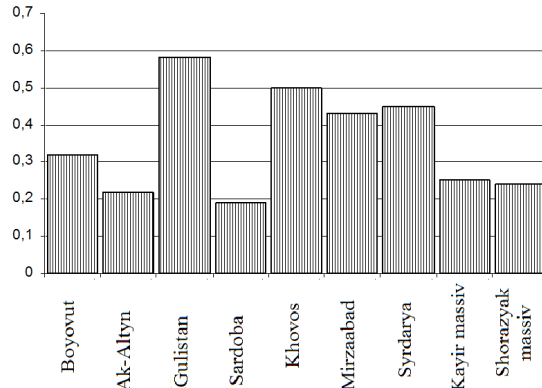


Figure 8. Level of drainages

Khovos and Mirzabad districts cotton yield was 1,5–1,6 thousand kilogram per hectare and wheat yield 2,2–2,8 thousand kilogram per hectare (Figure 9). It show that crop productivity was various according to soil salinity level.

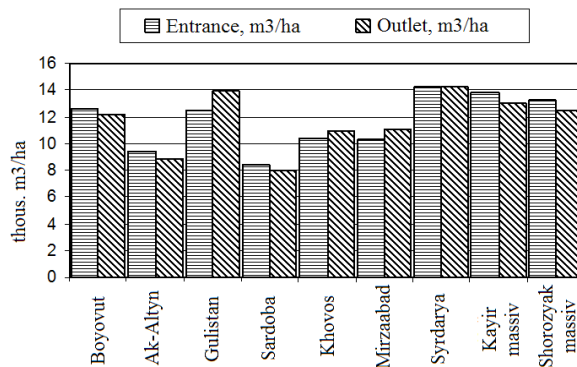


Figure 10. Water balance by district

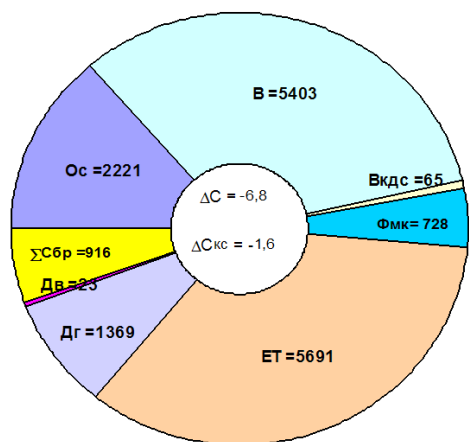
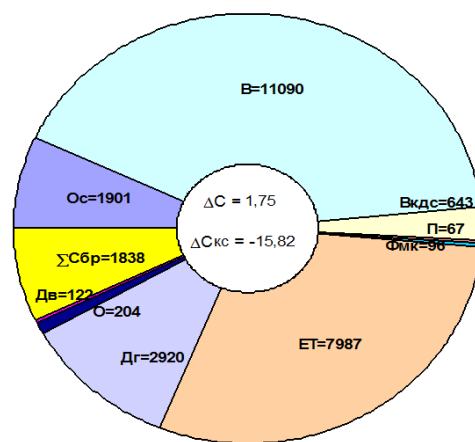


Figure 11. Water balance of Sardoba district



12. Figure Water balance of Kayir massiv (Sayhunabad district)

Here: O_c — amount of precipitation, m^3/ha ; B — amount of irrigated water by canal to district, m^3/ha ; B_{kac} — amount of used water

for irrigation from collector-drainage system, m^3/ha ; B_{ba} — amount of used water for irrigation from vertical drainage, m^3/ha ; Π — amount

of water came from underground, m^3/ha ; Φ_{mk} — amount of filtration from main canals, m^3/ha ; ET — amount of evapotranspiration, m^3/ha ; Δ_r — amount of water went through horizontal drainage, m^3/ha ; O — amount of water flowed from underground, m^3/ha ; Δ_b — amount of water went through vertical drainage, m^3/ha ; $\Sigma_{c\bar{p}}$ — total amount of waste water, m^3/ha ; ΔC — change of salt base over the balance contour; ΔC_{kc} — change of salt base in root zone.

Conclusion

Has been done complex analysis of meliorative processes in Syrdarya province including water-salt balance, causes and directions for improvements.

Improvement on meliorative status of Syrdarya province in progress and yearly 0.5–21 tons/ha salt has been decreasing. But,

because of inefficient use of water resources and leaching technologies most of lands still salined which effective crop yield.

Structured drainages in irrigated lands are currently functioning in satisfactory level. Nevertheless, if during non-vegetation period the water for leaching will be in required level the technic condition and functioning of drainages will be well.

Rehabilitation of vertical and horizontal drainages also maintain pumps and motors including changing of old parts is needed.

Use of drainage water during vegetation period in Boyovut, Gulistan, Syrdarya and Sayhunabad districts could minimize limit of water use from canals and provides chance to irrigate more water to Ak-Altyn, Khovos, Sardoba, Mirzaabad districts.

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