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Establishment of the dependence of salt balance parameters on the ratio of drainage flow to water supply based on the analysis of actual data on water-salt balances

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ABSTRACT: The article provides brief review of the existing studies in the field of reclamation hydrochemical processes and water-salt regimes under the influence of irrigation and drainage, *analysis* available actual data on water-salt balances at various Experimental Production Sites (OPS) of vertical drainage wells (VD), some calculation results and conclusions.

KEYWORDS: Water-salt balance, drainage flow, water supply, groundwater, groundwater depth, vertical drainage well.

I. INTRODUCTION

Throughout the world, great importance is given to research work on the protection of water sources. At forums and conferences dedicated to the water problem, they talk about improving the water supply of agricultural land, implementing a set of measures to protect water bodies, as well as the rational use of land and water resources. At present, the number of dry years has sharply increased in Uzbekistan, which leads to an aggravation of the distribution of limited water resources. This raises the problem of land salinization, reduced productivity and soil degradation and reduced agricultural productivity.

II. DISCUSSION

The published materials and available studies sufficiently reflect the direction of these meliorative-hydrochemical processes and water-salt regimes under the influence of irrigation and drainage. However, they do not sufficiently disclose the principles of the impact of one or another type of drainage on the formation of the active stratum of water and salt exchange under various conditions. The issue of the intensity of water and salt metabolism against the background of the operation of various types of drainage remains controversial. [1,5,6,7,8,9,10,11] The above circumstances lead to the need for scientific development of water-saving, ecological, land reclamation measures, the use of which stabilizes high yields of agricultural crops at low costs of water and material and technical resources.

III. OBJECT AND METHODS OF RESEARCH

Object of studyare the zones of vertical drainage of irrigated lands of the Republic of Uzbekistan along the river basin. Syrdarya. System analysis, methods of field experiments, generally accepted methods in land reclamation, mathematical models and their numerical calculations.

The results of the analysis of the available actual data on water-salt balances [1,2,3,4,5] at various Pilot Production Sites (OPS) and large vertical drainage well distribution systems (VDS) show the following. Under various irrigation regimes, land leaching, crop structure, water disposal regimes, the water-salt balances of the SP have, in the overwhelming majority of cases, a desalinization orientation. Analysis of the data (Table 1) of the water-salt balances of selected objects located in different natural and economic conditions show that in the incoming part of the water and salt balance, the main role is played by water supply to the irrigated field, which is up to 90% of the incoming part. The share of atmospheric precipitation as a whole was no more than 10-20%.

A characteristic feature for the objects of the upper reaches of the river. Syr Darya River is that at the PPU, located, for example, in the Ferghana Valley, there is an underground inflow of pressure and groundwater in a fairly large amount - from 3.5 to 4.7 thousand m3 / ha per year.

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In the expenditure part of the balance, the main place usually belongs to the total evaporation, the value of which in the conditions of the arid zone varied depending on the depth of groundwater from 5780 to 9100 m3/ha in cotton fields. The second place in the expenditure part of the balance belongs to the drainage runoff, diverted by vertical and horizontal drainage. The volume of drainage runoff diverted varies from 1400 to 8470 m3/ha.

Table 1.
Actual water-salt balances at pilot production sites for vertical drainage

No. p/n	Zone drainage, (author)	Main elements of water-salt balance, m3/ha; t/ha												
		Arrival per year				Total	Consumption per year			Total	Value water exchange	Salt balance		
		os	IN	F	P		ET	DR	ABOUT			Coming salts	Takeaway salts	Salt balance
1.	Ferghana Valley Mukhamedzhanov Sh. (1990)	1640	10370	1435	4160	17605	8240	8470	-	16710	-3770	18.2	29.2	- eleven
2.	Ferghana Valley Bekmuratov T. (1983)	750	9670	-	4724	15100	8000	8000	-	15750	-2620	11.6	24.0	-12.4
3.	Ferghana valley Usmanov A.U. (1982)	1259	7700	1685	3465	14109	6840	6840	-	14701	-2006	12.8	18.9	-6.1
4.	Syrdarya region. Kalyuzhnaya N. (1971)	2500	8950	-	-	11450	6248	6248	-	12023	-5675	11.2	64.4	-53.2
5.	Syrdarya region Abirov A. (1971)	2298	7043	-	-	9341	2000	-	-	9540	-1801	9.4	3.4	-6.0
6.	Syrdarya region Yakubov X (1978)	2000	10500	-	-	12500	4750	-	-	12750	-4500	12.6	19.0	-6.4
7.	Syrdarya region Reshetkina N., Yakubov H. (1978)	2000	9000	-	-	11000	3850	-	-	11690	-3160	10.5	21.9	-11.4
8.	Hungry steppe, Reshetkina N., (1985)	2320	9000	-	-	11320	4415	-	-	13515	-2220	10.8	22.08	-11.3
9.	Syrdarya region, Reshetkina N., Yakubov H.I., (1978)	1870	8200	-	-	10070	4000	-	-	11500	-2570	9.8	16.3	-6.5

When analyzing the ratios of the incoming and outgoing elements of the water balance (which is an important indicator), it was revealed that at all open-pit plots and large vertical drainage systems, the leaching irrigation regime was maintained during the period of their operation.
Since the ratio of water supply together with precipitation (B + Oc) to total evaporation (ET) was everywhere more than one - from 1.1 to 1.35, and in rice systems it reached 2.65.
The ratio of drainage runoff to total water supply (Dp/B + Os) usually ranged from 0.18 to 0.56 in cotton fields.

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IV. RESEARCH RESULTS

The results of the analysis of the water-salt balance show that the construction and proper operation of vertical drainage systems made it possible to maintain the leaching irrigation regime on the saline lands of the region in the annual cycle, and to divert groundwater in a timely manner on excessively moistened lands and ensure optimal water-salt, air, food and nutrient supply. regimen for plants.

Particularly favorable conditions were provided in the aeration zone of the irrigated field. If, before the introduction of vertical drainage systems at most of the pilot sites, due to the close occurrence of mineralized groundwater associated with insufficient efficiency of horizontal drainage, a positive balance was formed in the root zone with the arrival of salts from groundwater, then the construction and normal operation of vertical drainage ensured the outflow of salts from the aeration zone to lower horizons. The magnitude of the downward flow of water from the aeration zone (denoted as ± q) to the lower layers ranges from 100 to 1040 m3/ha per year.

As a result, on the territory of the considered areas, the salt balance of the aeration zone was formed according to the brine type. At the same time, the annual reserve of salt removal from the upper layers to the lower layers ranged from 1.5 to 5.3 t/g.

Significantly increase the drainage of irrigated lands and create a negative type of water-salt balance with the help of vertical drainage was also possible in other large systems. These are vertical drainage systems in the Kuva region - 230 wells on an area of 26.6 thousand hectares; Bayautsky and Shuruzya massif - 313 SVD on an area of 117.1 thousand hectares, etc. Water-salt balances for these systems are also given in Table 1.

The performed calculations and analysis of actual data made it possible to establish the dependence of the salt balance parameters on the ratio of drainage flow to water supply for various objects, which can be described by the following formula:

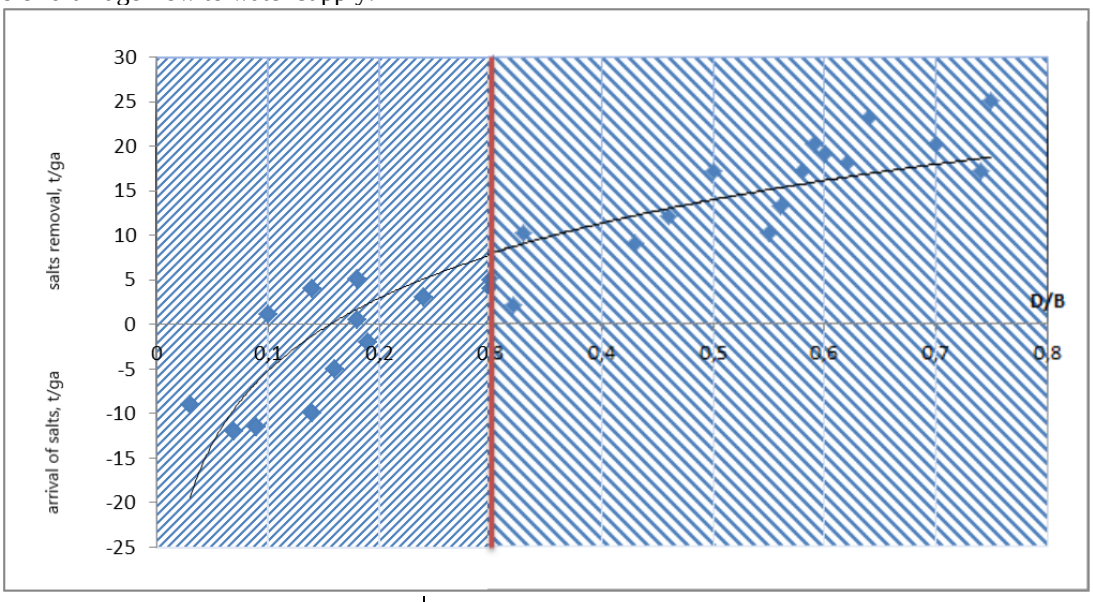
$$S = -26.3 (D/B)^2 + 64.72 (D/B) - 11.9 \quad (1)$$

$$R^2 = 0.87$$

Where;

S- Salt reserves, t/ha;

D/B - ratio of drainage flow to water supply.



I- Zone of non-pressure low-permeable groundwater | II-Zone of high pressure

Fig. 1. Dependence of salt balance parameters on the ratio of drainage runoff to water supply to the vertical drainage treatment facility.

V. CONCLUSIONS AND OFFERS.

An analysis of long-term data on the operation and technical condition of vertical drainage wells shows that, in general, the system works satisfactorily. However, at some sites, there is a deterioration in the operating conditions of vertical

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drainage wells, aging of structures, and a decrease in their production rates due to the lack of repair and restoration work. As a result, throughout the Syrdarya river basin, there is a partial decrease in the artificial drainage of the territory to 1930-2260 m3/ha, against the initial 5200-6100 m3/ha, which in turn causes the rise of mineralized groundwater and the accumulation of salts in the root-inhabited zone of soil and soil.

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