

G Summary of research project (see instruction on page 1)

1 Objective and technical fields:

Definition of groundwater salinity growth rate under VDS long-term operation

Objetives: groundwater use for irrigation expedientness, land and water resources efficiency increase achievement.

Meaning: water resources use productivity increase.

2 Scientific and technical approach:

Pumped water resources assessment with regard to their salinity and chemical composition correspondence to irrigation purposes possibility of their utilization without drainage to soil productivity.

3 Environment characteristics:

Climate is continental. Average annual temperature 12,5-13⁰ C. Time without freezing is 170-200 days. Precipitation is 1000-1280 mm. Relative air humidity is 55-60 %, in summer 25-30 %.

Geomorphology: Sir Darya alluvial valley. Slope is 0.0003-0.0005.

Lithology: quaternary sediments: cover loam (15-20 m; permeability coefficient 0.1-0.15 m/day) and small and fine-grained sand (25-100 m; permeability 20-30 m/day).

Groundwater level is 1.5-3.5 m. Water salinity is 5-20 g/l.

Soils: light, middle and heavy loam, sandy loam with salinity 1.5-3.5 % on solid residue and 1.2-1.8 % on chlorine.

Zones of vertical drainage spreading in Fergana and Bukhara province are characterized by better soils: water specific yield is 0.09-0.11, salt specific yield is 0.72-0.12 against 0.06-0.08 and 1.88-3.6 respectively in Golodnaya Steppe. Easy soluvable salts in Fergana valley are spread mostly within unsaturated zone, salinization is of slightly and middle level, type – sulfate.

In Bukhara province vertical drainage zone is characterized by two-layer thickness of aquifers – cover loam (15 m, permeability $K_p=0.5-1.0$ m/day) and gravel-pebble (>100 m, $K_p=40-45$ m/day). Soils have good water and salt specific yield $\mu=0.1-0.12$; $\alpha=0.75-1.5$.

Soil salinization occures mainly within 1m-layer, salinization type is sulfate. Groundwater salinity is 1.2-10.0 g/l.

4 Parameters of Pilot Projects and Technical Solutions:

Total area of VDS in Golodnaya Steppe was 374.6 th.ha (1985); number of wells was 1660; depth 65-80 m; yield 100-150 l/sec/ha and total amount of pumped water was 40-60 cu.m/sec.

In Fergana valley total VDS area was 43.2 th. cu.m./ha.ha, number of wells – 533; depth – 20-60 m; one well yield 8-90 l/sec; total discharge was 28-35 cu.m./sec.

In Bukhara province total VDS area was 51.9 th./ha, number of wells – 250; depth – 25-45 m; yield 25-40 l/sec, total discharge – 8-10 cu.m/sec.

5 Methodology:

Field observations on groundwater salinity and chemical composition dynamics, monthly measurements of wells yield and annual measurements of VDS parameters.

Systems analysis was used as a method of obtained data processing.

6 Results:

Pumped water salinity change is very complex process which depends on easy soluvable salt content and distribution, water supply regime and lithology. On the base of previous investigations certain types of groundwater salinity changes could be singled out:

1. Salinity increase. This type of process is formed within old developed lands with groundwater of relatively low salinity under VDS operation efficiency 0.6-0.7. Within the Golodnaya Steppe pumped groundwater salinity increase was observed within Shuruzyak system (from 0.8-1.5 to 2.5-3.7 g/l) during 15 years of operation.

Sardoba scheme and Karoy sink where initially easy solvable salts were located mainly within unsaturated zone. Their concentration is 2.5-3.5 %. Shallow groundwater salinity is much higher than of deep pumped aquifer (1.5-1.6 g/l). Leaching regime of irrigation promoted salt transference from upper layer to deep aquifer and pumped water salinity increase (on 0.7-2.2 g/l in long-term period).

Within the Fergana valley this type of process was observed in Kirov and Kuva districts where significant salt stock was accumulated within unsaturated zone, but water salinity changes were irregular.

Salinity increase duration was 6-7 years. Similar type was noticed in Bukhara province (Zerfshan lower reaches, where soils were strongly salinized).

2. Gradual salinity decrease. This type is formed within old developed lands where salinity of shallow and deep water is almost equal or close under low VDS operation efficiency (0.4-0.5).

3. Stable type is characterized by absence of pumped water salinity changes (change is 0.2-0.5 g/l). It is formed within old developed lands under low VDS operation efficiency (0.2-0.3). In this case water exchange between shallow and deep groundwater is negligible and does not influence pumped water salinity. This type spreads over non-salinized soils.

4. Stable type but with high salinity is formed within undeveloped zones where there is much of easy solvable salts within unsaturated zone. Water salinity is 10-12 g/l.

It is noticed that when VDS operates but irrigation is absent water salinity decreases on 1.5-2.0 g/l, but under irrigation it increases again.

Pumped water salinity change process can be splitted into 3 periods: a) salinity increase; b) relative stabilization; c) salinity decrease.

By investigations is proved that within the Golodnaya Steppe VDS active zone spreads to depth 100 m (1.5 well depth) and salt exchange active zone is 25-30 m. In Fergana and Zerfshan valley this zone achieves 25-70 m, and salt exchange zone – 8-16 m.

H	Suggested key-words		
1	Vertical drainage system (VDS)	4	Active water exchange zone
2	Groundwater salinity	5	Active salt exchange zone
3	Water chemical composition	6	Soil and water desalinization

I	Most recent publications (maximum 3)			
1	Author(s): Soifer Sergey			
	Title: Investigation of drainage effluent salinity dynamics of arid zone			
	Publication details: Conditions of pumped water salinity and chemical composition formation, depending on initial salt stock within cover loam, groundwater and deep aquifer and VDS operation efficiency are considered.			
	Year of publication: 1977	free access <input checked="" type="checkbox"/>	Restricted <input type="checkbox"/>	Confidential <input type="checkbox"/>
2	Author(s):			
	Title:			
	Publication details:			

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3	Author(s):			
	Title:			
	Publication details:			
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