CHAPTER 2. INVESTIGATIONS ON PILOT PLOTS ON SOIL WATER-SALT REGIME AND ECOLOGICAL-MELIORATIVE PROCESSES ON BACKGROUND OF DRAINAGE AND LEACHING OF SALINE LANDS

INTRODUCTION

At present time within Central Asia about 7.95 mln. ha of lands are irrigated, from which more than 5.0 mln. are saline and exposed to salinization. Saline soils cause definite damage to agricultural production. Depending on degree and type of salinity the damage is found not only by agricultural yield losses, but also by losses of water and labor resources and inputs. Under this situation slightly saline soils yields losses vary within 15-20 %, medium saline- within 20-50 % and strongly saline - 50-80%. Annual water consumption of irrigated field with non-saline soils is 20-50 % lower than that for saline ones.

The same picture of damage is observed also for inputs and labor resources. In connection with this the struggle with salinity is considered as important problem of irrigated agriculture. Almost all over the world solution of this problem is based on strengthening of drainability of irrigated areas by means of artificial drainage and soil leaching and leaching regime of irrigation on background of drainage.

Other methods of salt removal from soil thickness do not exist yet. All available methods proposed for introduction in practice provide or relieve only removal of salt mass from soil thickness. At the same time in certain regions presented by automorphic soils with ground water level lower than 5 -10 m it is possible to prevent secondary soil salinization through prevention of ground water level rise by means of vertical drainage system, providing on its background weak leaching regime of irrigation within the vegetation period. As far as soil desalinization is based on artificial drainage use, in Central Asia while developing and reclamating saline lands different types and structures were used widely: horizontal open, close, vertical and combined drainage system.

Over 5.2mln. ha from common irrigated area of Central Asia artificial drainage need to be constructed. Actually 4.7 mln. ha (60 % of irrigated area) are provided with drainage. All irrigated massifs of the Aral side critically need drainability to be strengthened.

Irrigated lands of the Republic of Uzbekistan, South Kazakhstan and some regions of the Republic of Tadjikistan and Kyrgyzstan are provided by drainage best of all. Especially, unfavorable situation with land drainability turn out in Turkmenistan, where 500 000 ha of irrigated lands are not provided by drainage. General extent of collector-drainage network on area of 4.7 mln.ha of irrigated lands by 1.01.1994 is 174.5 th. km (or 39. 4 m/ha), including 145.4 th. km of on-farm networks. Inter-farm network and most part of on-farm network are presented by open collectors and drains (54 % of common extent). Close horizontal drainage is used on area of 1292 th.ha and all over the new irrigation massifs. Depth of close horizontal drainage varies within 2.5 -3.5 m. Close drainage became widely developed mainly in the the Republic of Uzbekistan. From 1292 th.ha of lands with close drainage this republic has part of about 1000 th.ha. In old irrigation zones open horizontal drainage is mainly used, depth of which varies from 1.8 to 2.5 m and collectors depth up to 4.5 -5.0 m. Vertical drainage systems were built on area of 794 th.ha, where about 8650 th.ha of high capacity wells are maintained. Average load per one well is 85.5 ha and maximum command area of one well is 250-300 ha (old zone of the Hungry Steppe) Vertical drainage is widely developed under saline lands reclamation of old irrigation zone of the Republic of Uzbekistan (The Hungry Steppe, Fergana Valley, Bukhara province, Karshi and Surkhandarya steppes) and South Kazakhstan -Hungry Steppe, Kzyl-Kum, Arys-Turkestan massifs as well as Kzylorda province.

Actually in all regions of artificial drainage development the certain reclamation effect was achieved, where under normal level of drainage operation and leaching regime of irrigation the negative water-salt balance of irrigated lands is formed with salt removal from 5 -10 to 50 tn/ha. The highest reclamation effect is observed in zones of perfect type drainage development. On background of drainage systems constructed in the Aral Sea basin annually up to 36 -40 km^3 of drainage effluent is formed with salt removal 120 -130 mln.tn per year, most part of which come back to river trunk contaminating them.

However, construction and operation works on intensive artificial drainage of lands by perfect types of drainage expanded within 1960-1980, recently were stopped in all republics of Central Asia because of limited means and expensive materials for their construction. At the same time in all republics, excluding Uzbekistan, actually drainage system exploitation is out of interest. Meanwhile, high efficiency of drainage perfect types is revealed not only in improvement of reclamation state of irrigated lands but also in irrigated water economy, conservation and increase of agriculture crops yields as it was shown from materials presented in IPTRID Registers on direction II «Evaluation of previous pilot projects on irrigation and drainage».

Information about management of soil water-salt regime and reclamation-ecological processes on background of drainage, irrigation and saline lands leaching is presented in 75 pilot projects located in different natural conditions of the Aral Sea basin. Ten of 75 objects include information about large regions and massifs of 50 -100 th.ha and 7 - on capital leaching on background of different types of drainage.

Pilot projects distribution over republics is as follow (see Appendix 1).

- The Republic of Uzbekistan - 41, including 15 related to vertical drainage system;
- The Republic of Kazakhstan -18, 14 pilot projects of which are relevant to vertical drainage system;
- The Republic of Tadjikistan -9, including 2 objects with combined system of vertical and horizontal drainage;
- Turkmenistan -4 objects presented by horizontal drainage;
- The Kyrgyz Republic -3, including 1 object relevant to vertical drainage system.

Depending on natural conditions horizontal drainage system is used on low permeable deposits with permeability coefficient of 0.03 -3.0 m/day. This type of drainage is used also in cases of two- and multi-layer sediments with thickness of top fine-grained deposits $< 3 \div 5$ m, as well as in conditions of strongly differentiated relief. Examples of horizontal drainage large systems development are in new zones of Hungry, Karshi, Djizak, Sherabad steppes, the low reaches of SyrDarya and AmuDarya, Chu valley of Kyrgyz Republic, Tedjen and Mary provinces of Turkmenistan, and etc. Vertical drainage is developed on territories, where lithology presented by two- and multi-layer sediments with aquifers of conductivity (Kf x m) more than 200-500 m^2/day. This kind of drainage gave the biggest result in conditions, where thickness of fine -grained deposits varies within 10-45m, and sediments resistance ($F = \sum_{i=1}^{n} \frac{M_i}{K_{Fi}}$) is from 25 to 700 days. Under thickness of fine-grained deposits ≤ 10 m the vertical drainage creates big unevenness of ground water level reduction over the territory and under m ≥ 45m an effect reduces due to increase of fine-grained deposits resistance. Under conditions, where the thickness of fine-grained deposits ≤ 10 m, the best indicators of reclamation efficiency are achieved under combined drainage. Objects of wide introduction of vertical drainage in Central Asia are Fergana valley, Bukhara oasis, old zone of the Hungry Steppe irrigation, part of Karshi and Sherabad steppes as well as rice massifs, the low reaches of SyrDarya river on territory of Kazakhstan and irrigated command areas of Arys-Turkestan canal.

Presented information on pilot plots of drainage shows the high reclamation and technical-economic efficiency of drainage perfect types, which is expressed in:

- drainage outflow management;
- management of soil water-salt regime and water-salt balance of irrigated lands;
- acceleration of soil and ground water desalinization as well as reduction of drainage effluent mineralization;
- increase of agricultural crops yields;
- water saving
- promotion of agriculture on saline lands.