Justification of forming optimum water & salt regime of dark chestnut soils against the background of vertical drainage under complex hydrogeological conditions of the Krasnoznamensk irrigation system

V.V. Morozov, Professor; A.I. Bulygin
Kherson State Agrarian University,
23. R. Luxemburg str., Kherson, 73006, Ukraine
E-mail: gis@ksau.kherson.ua

Under present-day conditions, irrigation and vertical drainage regimes were broken in the south of Ukraine. In the Primorsk zone of the Krasnoznamensk irrigated area, which is characterized by difficult hydrogeological conditions, this has resulted in widespread rise of groundwater table up to 2-3 m and closer to land surface. Adverse processes of the influence of shallow groundwater in the dark chestnut soils, like alkalinization and repeated salinization, cause a risk to stable soil fertility and guaranteed crop yields.

The long-term investigations (1989-2009) on formation of water and salt regime in the dark chestnut soils of the Krasnoznamensk irrigated area were carried out against the vertical drainage. Optimum soil moisture, moistening layer, and reclamation regime allowing for the use of closely located (1.5-3 m) low-saline (1-3 g/dm^3) groundwater were determined for winter wheat - the main crop in irrigated crop rotation.

The regularities in formation of water regime and dark chestnut soils' physical and chemical properties under changed "irrigation-vertical drainage" system operation conditions from the design (1989-1992) to the present-day conditions of limited resources under unstable economic conditions were identified, as well as further direction of their development were forecasted. The experimental and field verification of the results obtained was carried out on a similar object. The parameters of the optimum reclamation regime which provides guaranteed yield of crops with maintained soil fertility and environmental sustainability of agricultural landscape.

Optimum regime of the dark chestnut soils under the conditions of low-drained and drainless agricultural landscape of the Primorsk dry zone of the Krasnoznamensk irrigated area is provided by the following soil formation indicators: irrigation water salinity – from 0.5 to 0.7 g/dm; type of the chemical composition of water – sulfate & hydrocarbonate, magnesium & calcium; irrigation rate (for winter wheat) – 1900-2000 m^3/ha; average vegetation groundwater table – 2.0-2.4 m; average non-vegetation groundwater table – 1.8-1.6 m; total water salinity in the layer – 0-100 cm with chloride and sulfate type of salinity – from 0.1 to 0.15 %.

Parameters of optimum operation of vertical drainage are as follows: drainage flow modulus – 0.025-0.045 l/s per 1 ha; water drainage for vegetation period – 800 m^3/ha, for non-vegetation period – 250 m^3/ha, and for year – 950-1150 m^3/ha; water drainage factor – 20-25 %. Economic productivity under implementation of optimum reclamation regime is 800-900 rouble/ha; average irrigation water saving – 80-150 m^3/ha at high profitability of irrigated hectare and average cropping capacity of winter wheat of 4.3-4.5 ton/ha.