



Concept of non-uniform irrigation technology for complex soil cover within irrigated field

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Major land degradation problems in the geographical region called Saratovskoe Zavolghie going along left bank at the middle part of Volga River (Russia) are caused by long time large scale irrigation projects started since the middle of 1960th. At this region water for agricultural and domestic purposes is pumped from Volga River and mounted to uphill areas by networks of pumping stations and open transportation canals in some cases going till hundred kilometers into desert & semi-desert areas. In irrigated areas water is pumped from these canals by lateral pumping stations distributing it to pivot sprinkler machines. These machines are carrying out water application at the irrigated field areas of around 40-50ha.

Nowadays, this region is characterized by steady tendencies of a climate change aside aridification and formations of shortage of local water resources. Agricultural activities under irrigation are influenced by degradation of land and water resources as well and high final cost of agricultural production due to high water doses using for irrigation, high price for water pumping & transportation and quite low average productivity.

In the frame of FP6 DESIRE 037046 (2007-2011) project aiming to assess main land degradation driving processes in Saratovskoe Zavolghie region as well as introduce an appropriate innovation technologies it was shown that an extensive irrigation at this region provoked a considerable ground water table rising and by consequences secondary soil salinization.

After field experiments it was shown that ground water rising at irrigated areas is originated by considerable irrigated doses as well as irrigated water losses presumably by preferential flow process descending it into deep soil & ground layers and reaching ground waters. In their turn these losses of applied water applied have been provoked by commonly used technology called "uniform rate irrigation" that are not appropriated to complex soil cover structure of irrigated fields due to spatial non-uniformity of key parameters like mezo-topography, water holding capacity and infiltration rate. During water application by such type of technology where the soil intake rate is exceeded, thus causing water run-off with water ponding in micro- and mezo-depressions with following water seepage by preferential flow and as consequence - groundwater rising, secondary salinization/alkalinization leading in their turn to degradation of land & water and environment. At the same time inside of irrigated fields there is development of areas with root zone over or under moistured exhibiting water stress of crop plants and finally provoking low productivity and lost of yield.

As a practical consequence of this study a new concept of irrigation technology called "non-uniform irrigation" is proposed. After this concept this technology should provide site-specific irrigation management by the application of different volumes and/or rates of irrigation water to different areas of a field matching spatial non-uniformity of soil cover structure, water holding capacity of root zone, water infiltration/drainage rates, ground water depths as well as soil salinity/alkalinity.

Experimental results of soil moisture monitoring at field irrigated with the use of "uniform rate irrigation" as well as results of computing simulation with scenario of "non uniform rate irrigation" with their spatio-temporal interpretation are presented in the contribution. Main options of supportive mapping technology aiming to delineate irrigated field into quasi-uniform areas are discussed.