G-2 Study on the Development of Technology for the Rehabilitation of Soils with Salt Accumulation in the Central Asia

Contact person Matsui Shigeo
International Research Coordinator
Japan International Research Center for Agricultural Sciences
Ministry of Agriculture, Forestry and Fisheries
1-2, Ohwashi, Tsukuba, Ibaraki, 305-8686 Japan
Tel :+81-298-38-6346 Fax:+81-298-38-6342
E-mail : smatsui@jircas.affrc.go.jp

Total Budget for FY1996-FY1998 165,183,000 Yen (FY1998 37,216,000 Yen)

Key Words Salt Accumulation, Soil Reclamation, Water Management, Crop Rotation

The research was conducted in a farm located near the lower reaches of the Syr Darya River of the Republic of Kazakstan. The electrical conductivity of saturation extract (EC_e) of the surface soil of abandoned and cultivating fields even in a newly developed land, exceeding the value demarcating saline soil. Salt accumulation was affected by groundwater level and soil texture of lower horizon. Although the fraction of initial soil EC remaining after leaching showed high spatial variability, the average EC fraction showed the slightly higher leaching efficiency with intermittent ponding (IP) than with continuous ponding (CP). Soil column study showed that the leaching efficiency was similar or higher with IP than with CP depending on the soil texture. It was attributed to unsaturated or saturated flow. The saturated hydraulic conductivity (HC) of initially saline soils decreased with solution with 1 dS/m of EC and distilled water; 60% and 40% of HC was obtained respectively compared with solution with higher EC. The decrease in the soil HC was mainly due to clay dispersion and flocculant to be used in sewage treatment was considered promising as a soil conditioner.

Based on a series of on-site water and salt balance experiments, it was proved that the commonly-practiced eight-year rotation system and the over-irrigation together with the inappropriate drainage management have accelerated the salt accumulation and concurrently increased abandoned farmlands. A remarkable finding was obtained on the salt behavior in rice fields, and this denies the hypothesis that the rice cropping in arid area is effective for leaching accumulated salts. To overcome secondary salinization, several remedial measures are recommended: (1) to unify either upland crops or rice in an irrigation block to control groundwater table, (2) to decrease conveyance and field application losses through improved canal construction and management performance, and improved land-leveling performance, (3) to maintain and operate drainage canals properly, especially to install drain pipes across dikes for connecting fields and field-drains for enhancing subsurface drainage function, (4) to introduce bio-drainage along canals for preventing waterlogging and salinization, and so on.

In the first year, the information concerning irrigated agriculture or salinized soil problems was collected by visiting some locations and institutes of the Aral Sea region. In the second year, the whole duration was consumed for constructing an experimental field in the salt-accumulated and abandoned fields including construction of open drainage and boundary ditches between the treatments, reconstruction of water-gates and irrigation canals, installation of the fence around the field to protect crops against cattle, and so on.

In the third year, crop production in the heavily salt-accumulated field after leaching succeeded at first time in Kazakstan and a lot of information on seasonal changes of the levels and quality of groundwater in and around the fields was collected. Interrelations between the salinity of groundwater or soils and growth levels of the crops planted were analyzed.