Agricultural production technologies by saving water and soil amendment

Sadahiro YAMAMOTO
Faculty of Agriculture, Tottori University, Tottori, 680-8553 Japan

1. Introduction
The importance of agriculture in arid lands is increasing with increasing world population. Irrigation has greatly contributed to increasing crop yield there. However, low water quality, unsuitable irrigation methods and salt accumulation in the soil (Fig. 1) have decreased crop productivity. In order to increase yield and maintain high productivity of fields in arid lands, it is indispensable to analyze these detrimental factors and overcome the problems caused by the factors.

The goal of the Agricultural Production Group in the Global COE Program is to establish sustainable irrigation agriculture in arid lands. To achieve the goal, studies regarding to technologies for 1) sustainable use of fields by saving water and fertilizers, and those for 2) diagnosis and amendment of soils are conducted. Each study consists of some researches shown below. These studies not only establish sustainable technologies but also develop environmental conservation in arid lands.

2. Researches
For sustainable use of fields in arid lands, two studies on management of soil, water and fertilizers and on application of new technology for saving water are conducted.

The former consists of four researches of 1) creation of real time monitoring system of soil water and salts and evaluation of measurement accuracy, 2) diagnosis of soil salinization causes by salt water irrigation and leaching, 3) development of collecting apparatus of infiltration water in soil and evaluation of measurement accuracy, and 4) fertilization management with slow release fertilizers for reducing stresses to environment.

The latter consists of two researches of 1) influence of irrigation rate on yield and quality of crops for establishing technology of saving water and 2) water saving technology by using temperature responsive water holding materials which absorb water at low temperature and release it at high temperature.

For diagnosis and amendment of field soil, three studies on technologies of diagnosis of soil salinization, on phytoremediation of salt accumulated soil with salt tolerant plants and on technology of applying organic materials for soil amendment are conducted.

The first study consists of two researches of 1) development of easy evaluation methods of process of soil salinization by scoring its factors and 2) assumption of salinization process and factors of special variation of risk in irrigation lands.

The second study consists of 1) salt removal from field soil using salt tolerant plants such as beets and halophytes such as Salicornia useful for food and forage and 2) evaluation of salt removing ability and quality for food and forage of above plants.

The third study consists of 1) development of technology for prevention of soil sodication by application of organic materials which can dissolve calcite and supply calcium to the soil and 2) development of soil amending materials by carbonization of plants and mineralization of organic wastes such as poultry litter.

These researches are conducted in Lower Syr-Daria Basin, the Loess Plateau and Provinces of Xinjiang, Shanxi and Hebei in China. At the end of five-year studies, manuals on technology for sustainable irrigation agriculture in arid regions will be presented.