

Examination of impact of fertilizer application on drain water quality using Sr isotope in irrigation district, Turkey

Takashi Kume^{1*}

¹RIHN

The management of drain water from irrigated lands is an important issue not only for agricultural management but also for environmental conservation. In arid and semi-arid regions, drainage water is reused as irrigation water due to lack of enough fresh irrigation water and irrigation schemes. The drainage water reuse should be undertaken only if long-term deleterious effects on soil properties can be avoided. The origin of salts of drainage water should be examined to avoid any agricultural and environmental pollution.

The Lower Seyhan Irrigation Project (LSIP), Adana, Turkey, faces to the Mediterranean. In the LSIP, intensive irrigated agriculture has conducted since 1960s. Recently, total amount of applied irrigation water has been increased along with expansion of agricultural area and fertilizer input is also increasing. Some part of the southern lowest fields is under sea level. Soil salinization and shallow groundwater have been observed in the lowest part of the LSIP due to irrigation water seepage from upper stream and insufficient drainage. Moreover, agricultural drainage water has been used for irrigation water there. To achieve sustainable agriculture, it is indispensable that clarification of source of salts, effect of fertilizer on soil salinization and effect of irrigation water leaching on soil salinity. Geo-chemical measurements are needed to reveal them.

In this study, we selected three main drainage canals of the LSIP to determine the isotopic and chemical compositions of drainage water from outlets of those canals. Seasonal changes in drainage characters were examined using $87\text{Sr}/86\text{Sr}$ ratio (Sr isotope ratio) and major cation data. Possibility of application of three components mixing model was discussed. Finally, impact of irrigation water and fertilizer on drainage water salinity were examined.

The result of measurements showed that there was a good relationship between $87\text{Sr}/86\text{Sr}$ value and reciprocal value of Sr concentration, while drain water quality clearly differed between summer irrigation season and winter non-irrigation season. This result shows that Sr of drain water consists of Sr of several origins. From the result of comparison of measurements, it is shown that Sr of drain water is a mixture of three components, irrigation water, fertilizer and exchangeable Sr of soil originated from old seawater. The abundances of three components were calculated for both summer and winter seasons. According to the results of calculation, abundances of fertilizer of drain water of three canals were 24-47% in summer and 57-78% in winter. The abundances of irrigation water and old sea water are 51-74% and 2-6% in summer, and 18-22% and 2-21% in winter, respectively. This study revealed that elements from fertilizer drain in less rainfall winter season in irrigation district where irrigation water applied more than 1,000 mm. Sr isotopic ratio is an effective index to trace elements from fertilizer in irrigation district and it provide useful information which allows us to plan effective fertilizer management.

Keywords: Sr isotope, agricultural drainage, fertilizer, salinization, irrigation