土壌水分中のNO_3^-の移動速度推測と地下水への影響ーー生口島を例として

The migration of nitrate and possible impacts on groundwater of Ikuchi Island, Japan

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Nitrogen is one of major elements for crops, which directly affects the production of agricultural. However, excessive application of nitrogen fertilizers can lead to a variety of environmental issues. Therefore, it's important to investigate the mechanisms and magnitude of nitrogen migration.
Ikuchi Island located in Seto Inland Sea, is one of the most famous orange and lemon production areas in Japan. Orange and lemon groves cover 42% of this island. To maintain and improve the yields, much fertilizer (~2400 kg ha^{-1} $year^{-1}$) is applied during a whole year and nitrate contamination in this island was very serious (Onodera, et al., 2007). In order to evaluate the spatial and temporal variations of NO_3-N in soil water, several observation wells with different depth (10cm, 30cm, 50cm, 70cm) were installed in one square meter of space of one orchard in Ikuchi Island. 1000ppm of KNO_3-NO_3 and NaCl-Cl mixtures were shed on the surface of this one square meter of space in August 20^{th}, 2015. After that, water samples were collected from these wells every two weeks and analyzed for NO_3-N, Cl.
The results showed that the highest concentrations of NO_3-N in 10cm and 30cm, 50cm and 70cm were occurred in August 30th, 2015, the second water sampling time and September 15th, 2015, the third water sampling time, respectively. In addition, the peak value of concentrations of NO_3-N decreased with the increase of soil depths except 10cm. This may attributed to the fact that the interval time between the first and second water sampling was 10 days, the peak value of NO_3-N may have passed before we took water samples. From the relationship between the C_N/C_{Cl} (the ratio of concentration of NO_3-N and NaCl-Cl) and time, we found that the value of C_N/C_{Cl} from 10 cm to 30cm decreased very rapidly. Moreover, it's easier to collect water from 30cm than other depths, which may imply that place near to 30cm may be the most humid locations. Therefore, denitrification may take place in the depth from 10 to 30cm, resulting in the decline of NO_3-N concentration. The migration rates of NO_3-N in soil water were estimated to be about 3.0cm/day and 2.5 cm/day in the depth from 0cm to 30cm and 30cm to70cm. The groundwater level is about one meter in this area, NO_3^- would migrate into groundwater about 24 days later after 1000 ppm nitrate fertilizer was applied.

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