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Analysis of the characteristics of nitrogen and phosphorus losses during different periods from a complicated natural-artificial catchment in Japan

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Nowadays, more and more natural catchments have been developed into agricultural cropping or industrial production areas. Thus, the quantities and qualities of drainage water from the catchments have altered dramatically after the changes of land uses. Meanwhile, water pollutions by excess nitrogen and phosphorus non-point source pollution from agricultural areas have become severe problems for water quality control. To control nutrients infiltrating losses into groundwater or discharging losses in surface water from these agricultural areas, it is necessary to research nutrient loading in the infiltration water or drainage water, the mechanisms and the influencing factors for eutrophication of receiving water bodies.

In this study,a complicated natural-artificial catchment, which is composed of natural forest (73% of the area) and artificial terraced paddy field (27% of the area) in Ehime Prefecture, Japan, is selected as an experimental site for analyses of the characteristics of nitrogen and phosphorus losses from the catchment during different periods. Water sampling, meteorologicaldata collecting and runoff monitoring were conducted during storm runoff, subsurface runoff and base-flow periods in Dec., 1996-Feb., 1998 in the catchment.The concentrations of TN, TP, NO_3-N, NO_2-N, NH_4-N and PO_4-P of the water samples were analyzed according to the standard of Japan. Besides, water quality model is developed by analyzing the relationship between specific nitrogen and phosphorus loading and specific runoff discharge during different periods. We find that close linear relationship exists between the specific nutrient loading and specific runoff discharge from the catchment during different periods.

Through analysis of the relationship between the runoff discharge and the loading of nitrogen and phosphorus in the discharge water from the catchment during different periods, the characteristics of the nutrients losses from the complicated natural-artificial catchment are studied. The conclusions are drawn as follows:

During storm runoff, the concentrations of TN, TP and PO_4-P rise quickly with the increase of storm runoff at the beginning of the storm; and then drops quickly with the recession of the storm runoff period; meanwhile,the concentrations of NO_3-N, NO_2-N and NH_4-N change slightly during the storm runoff period. Besides, the concentrations of nitrogen and phosphorus in the discharge from the complicated natural-artificial catchment have good relationship with the specific discharge from the catchment in the period.

During subsurface flow period, the concentrations of nitrogen and phosphorus in the discharge water from the complicated natural-artificial catchment are much lower than those in the storm runoff period, and also have good relationship with the specific discharge from the catchment in the period.

During base flow period, the concentrations of nitrogen and phosphorus from the complicated natural-artificial catchment are much lower than those in the subsurface flow period, which are much lower than those in the storm runoff period. And the concentrations of nitrogen and phosphorus in the discharge from the complicated natural-artificial catchment also have good relationship with the specific discharge from the catchment in the period.

Keywords: characteristic; nitrogen and phosphorus; losses; different period; a complicated natural-artificial catchment