INFLUENCE OF NATURAL AND AGRICULTURAL FACTORS ON NITROGEN LEACHING IN CATCHMENTS OF SMALL STREAMS

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Abstract

Much data on nitrogen leaching from crop fields has been published in the countries of developed agriculture, however, the research on tendencies of nitrogen pollution in post-Soviet countries, in which agricultural activities are changing very rapidly, is particularly scarce. Authors of the presentation have been investigating the change of water runoff and leaching of total nitrogen (N) with the change of natural conditions and agricultural activities in three catchments of Lithuanian agricultural activities (Western, Middle and Southeast Lithuania) for ten years already. The analysed small river basins vary in climatic conditions, soils, land use and farming intensity.

In 1996–2006 the mean annual runoff and N concentrations at the outlets of the analysed streams varied a lot. The runoff varied from 159 to 240 mm and N concentration – from 2.4 to 5.9 mg l^{-1}. The highest runoff is of a stream in hilly Southeast Lithuania (it contains both precipitation and ground water). The highest N concentration is in a stream in the Middle Lithuania, in the catchment of which agricultural activities are the most intense and the rivers are nearly entirely fed by surface water.

Multifactor regression analysis for annual observations data suggested, that N concentrations in all analysed streams depends on the amount of precipitation, air temperature and N concentration in precipitation (R^2= 0.92; 0.83 and 0.56). The relation of monthly stream water N concentration data and natural factors in the catchments is weak. In different parts of Lithuania natural factors have unequal influence on the variation of N concentration in streams. A separate analysis of each natural factor suggests that the stream water quality in Middle and Southeast Lithuania are mainly influenced by precipitation (R^2= 0.72 and R^2= 0.61). In Western Lithuania N concentration in the stream is determined by the concentration of this element in rainfall and air temperature (R^2= 0.58 and R^2= 0.54).

The highest annual N load in 1996–2006 was in the Middle Lithuanian stream – 13.5 and the lowest was in the Western Lithuanian stream – 5.5 kg ha^{-1}. In separate years N load in the analysed streams varied up to 4–5 times. In the streams of Middle and Southeast Lithuania, which were further away from the sea, the maximum N load is observed in spring and in the stream of Western Lithuania, where the sea influence is felt – in winter.

To eliminate anthropogenic N load from the impact of stream runoff a semi-parametric flow normalization Mann-Kendall method was applied. Having distinguished the runoff impact in two streams an increasing N tendency was established, however, it cannot be stated that this is due to agricultural production intensification. A more comprehensive analysis shows that the increased N concentration in precipitation of late years would be able to determine such tendencies.