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The function of small pond as biogeochemical barrier on decreasing of different kinds of nitrogen in agricultural landscape

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Research Center for Agricultural and Forest Environment of the Polish Academy of Sciences has conducted long-term study on dissolved mineral and organic compounds in the water of agricultural landscape and dissolved organic compounds and their function in the cycle of organic matter.

This research deals with the problem of dissolved forms of nitrogen (N-NO_3^-, N-NH_4^+ and Norg) and phosphorus (P-PO_4^{3-} and P-org) in ground water under cultivated field and under afforestation as well as in surface water of two ponds. The first one is located in agricultural field, and the second one is adjoined to the afforestation. Additionally forms of nitrogen and phosphorus were determined in the precipitation and in run-off.

The object of this study was estimate how small ponds located in agricultural fields and afforestation fulfills the function of biogeochemical barrier with relation to nitrogen and phosphorus compounds migrating in ground water.

The content of N-NO_3^- is 89% and P-PO_4^{3-} 54% higher in water of small pond located in agricultural landscape than in ground water. Similarly, the content of N-NO_3^- and P-PO_4^{3-} decreased 61% and 65% in relation to ground water, respectively.

However, the content of N-org increased in both ponds by 16% and 27%. The content of organic phosphorus increased 35% in park pond. This investigations show that small pond fulfills function of biogeochemical barrier in relation to N-org and P-org.

The examination of surface water of two small ponds, which first one is located in

agricultural fields and the second one, is adjoined to the afforestation revealed similar concentrations of nitrogen and phosphorus forms. The content of N-NO_3^- is 89% and P-PO_4^{3-} 54% higher in ground water of small pond located in agricultural landscape than in ground water. Similarly, the content of N-NO_3^- and P-PO_4^{3-} decreased 61% and 65% in relation to ground water, respectively.

Our investigation revealed that high content of different kinds of nitrogen to surface water come from precipitation and from run-off. Organic nitrogen supplies high content. Yearly mean content of organic nitrogen in run-off ranged from 6,20 to 17,66 mg dm^{-3}. The concentrations of N-NH_4 in run-off are also high and ranged from 4,44 to 11,73 mg dm^{-3}. Ammonium very easily evolutes to the atmosphere and with precipitation returns and supplies ammonium deposit in soils. This is the reason of the high content of ammonium in precipitation.

The concentrations of all investigated compounds with exception of organic phosphorus decreased in ground water taken from the distance 16,5 m from the edge of the afforestation. After flowing of the water for 16,5 m of the afforestation the decrease of the following compounds was observed N-NO_3^- - 27%, N-NH_4^+ - 8%, N-org – 32%, P-PO_4^{3-} – 32%.

This investigation shown that afforestations and small ponds fulfill very efficient biogeochemical barrier in relation to N-NO_3^-, P-PO_4^{3-}. However they do not limit of the spread of P-org.