

ASSESSMENT OF UNFERTILIZED FIELD STRIP EFFICIENCY BY ANALYTICAL MODELS FOR LINKING SOIL SURFACE SOURCE ZONES TO SURFACE WATER RECEPTOR ZONES

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Lowlands are characterized by a relatively flat landscape and intensive drainage and discharge systems. Surface water pollution prevention demands for information on the position on magnitude of source areas. Areas with a shallow groundwater table are vulnerable for leaching of high adsorbing, non-decaying solutes (phosphate, heavy metals). The non-linear adsorption characteristic often yields a relative sharp solute and adsorption front after long periods of burdening the soil surface. The source area of the surface water loading can be characterized by the stream path pattern and the depth of the sorption front.

The hydrological conditions and solute decay properties exert influence on the denitrification which is considered as a governing process of nitrate reduction in riparian buffer strips. The stream path pattern plays a major role in understanding the mechanisms that determine the effectiveness of unfertilized field edge, as it is related to the width of the strips.

A quick scan of the unfertilized field strip efficiency with limited data available requires simple approaches, but also when detailed data are available and distributed models are applied, the conceptual description of solute transport is essential for the efficiency assessment. Distributed catchment models mostly have limited possibilities for refinement of the model discretization and riparian zones of 5 or 10 m width along field ditches and streams in intensively used agricultural areas do often not fit in the spatial discretization of these models. This demands for the incorporation of simple approaches, essentially based on 1D and pseudo 2D flow concepts within a spatial simulation unit, for describing 2D and 3D water flow and solute transport patterns along streams and in the hyporheic environment.

Simple analytical model were developed to address sorbing solutes and decaying solutes in either a thin soil layer drained by a perfect water course or an infinite thick soil system drained by a line drain. Different assumptions about the depth of the phosphate enriched zone or the reaction kinetics and the distribution of the denitrification parameters with depth were made. In our study it appeared that the effectiveness of an unfertilized field strip is dependent on both reducing the input and the specific position beside water course. The results of the study can be used in an appraisal of areas where buffer zones can successfully be installed and the model can also be used for the extrapolation of results of detailed models and extrapolation to other fields using a limited number of key parameters.