

Measuring buffer strip efficiency under deltaic circumstances

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There is experimental evidence from all over the world on the effectiveness of unfertilized buffer strips (BS) or riparian zones to reduce nutrient loads to surface water, but no experimental data is available on the effectiveness of BS (BSE) next to artificial drains in a deltaic plain with deep surficial aquifer, like the major part of the Netherlands. BSE is highly variable and influenced by many factors, but local hydrogeology is widely recognized as one of the key factors controlling BSE. In the delta a major part of the precipitation surplus is discharged to ditches via deep groundwater flow paths that do not interact with the BS. As most commonly used experimental methods that either focus on runoff or lateral subsurface groundwater flow are not suitable for deltaic plains, we had to develop a new method to measure BSE.

We installed 3 replicates of 2 treatments, each with a separate reservoir in the ditch, receiving water from the adjacent part of the field. The two treatments were unfertilized 5 m grass BS and a reference strip (RS). The RS was treated (fertilized) like the rest of the maize field. We measured discharge from BS and RS via the reservoirs and concentrations in water samples taken discharge proportionally to calculate nutrient loads from the treatments. Groundwater samples were taken at several distances from the ditch in the strips and adjacent field opposite each reservoir.

A clear decline in nitrate concentration was found in upper groundwater below the BS, compared to RS, but nevertheless little difference was recorded in nitrate concentration between the BS and RS reservoirs in the ditch. We calculated BSE in several ways based on groundwater concentration, loads to the reservoirs, flow concentration, for several time periods and accumulated discharge amounts, etc. Though based on the same data, each gave quite different results. Therefore a thorough discussion is needed to establish an objective method to calculate BSE under deltaic circumstances.