Evaluation of a denitrification wall: Putting microbes to work to fulfill numeric nutrient criteria.

Casey Schmidt

Over the last few decades, US fertilizer consumption has increased 20-fold and today anthropogenic nitrogen fixation has surpassed bacterial fixation. Demands for food, biofuels and other crops ensure that nitrogen demand will continue to increase. Agriculture is the most extensive source of groundwater nitrate pollution. Numeric nutrient criteria for nitrate of 0.36 mg/L are proposed, while surface water and groundwater concentrations at this agricultural research site exceed these standards by twenty and two-hundred times respectively. These proposed regulations would require much stricter reductions in nitrate loading from agricultural sources. The merits of a permeable reactive barrier for nitrate reduction referred to as a 'denitrification wall', was examined as a proposed BMP. The denitrification wall was constructed upgradient of a seepage headwaters by digging a 55 x 3.5 x 1.7 m trench and backfilling it with a mixture of sand and waste pine sawdust. Carbon supplemented within the groundwater contact zone instigates anaerobic conditions and subsequent denitrification. The denitrification wall has been monitored for six months utilizing three well transects and a paired watershed comparison. Within the well transects, nitrate decreased by 79% in 1.7 meters of groundwater flow length. The nitrate load at a downstream water monitoring station decreased from 533 kg/year to 142 kg/year for a reduction of 73% with no corresponding decline in the paired watershed, indicating the effectiveness of this technology at the watershed scale. This research demonstrates that denitrification walls could be a practical BMP due to their considerable nitrate reductions, low cost, and minimal maintenance.

Abbreviations: BMP – Best Management Practice.