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Managing Water for Tomorrow's Agriculture

USDA United States Department of Agriculture

IA-STORY1

Saturated Buffer

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SITE SUMMARY

The research is conducted in the East Indian Creek watershed on a private farm located near Nevada, IA. The field is a conventionally managed field with a corn-soybean rotation. The soil along the stream is a poorly to well drained Coland – Terrill complex.

In summer of 2015 a saturated riparian buffer (SRB) was established by installing a 407-foot-long distribution pipe about 46 feet away from the stream.

The 8-inch diameter tile outlet was used for the SRB. The drainage area for this outlet is estimated to be approximately 54 ac. The tile outlet was intercepted at the top of the buffer with the installation of a four chamber water-level control box. A 6-inch diameter perforated tile was installed as the distribution pipe approximately parallel to the stream at a depth of 30 inches below the ground surface, at a 0% slope. An unique aspect of the SRB was the stream banks had been reshaped as part of the overall watershed program resulting in a 14% slope across the buffer.

Observation Well Control Structure Drain Tile

Image 1. Map depicting saturated buffer site characteristics in Iowa.

Box 1. SITE INFO

CHARACTERISTICS

- Saturated buffer installed in 2015
- Rotation: Corn-Soybean

WATER MANAGEMENT PRACTICES

- Saturated Buffer (distribution tile: depth 30 inches , length 407 feet)

MEASUREMENTS IN DATABASE

DRAINAGE SYSTEM

- Tile Flow(2016-2018)
- Tile Nitrate-N (2016-2018)

SOIL

- Soil Texture (2015)
- Organic Carbon (2015)
- Percent Sand, Silt, Clay (2015)
- Soil Total N (2015)

WEATHER

- Precipitation (2016-2018)

Image 2. Sampling at saturated buffer site in Iowa.

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SUMMARY OF RESULTS

FLOW

Flow from the field tile and any flow exiting the control box directly to the stream was measured continuously starting on September, 2016. The difference between these measured flows represent the water entering the SRB. Flow rates in the tile ranged from 0 to over 7000 gal/min. depending on precipitation and evapotranspiration within the field. Nitrate concentration was measured at two transects of three wells across the buffer. Nitrate concentrations in the wells decreased as water from the distribution pipe flowed through the shallow buffer soil to the stream. Nitrate concentrations in the tile ranged from 3.2 to 14.6 mg-N L^{-1} over the three years of monitoring. Nitrate concentrations in the shallow groundwater in the monitoring wells nearest the stream ranged from 0 to 1.1 mg-N L^{-1} . The decrease in nitrate concentrations from the distribution pipe to the stream side wells was due to denitrification and possibly some plant uptake of the nitrate in the groundwater.

WATER QUALITY

Mass removal of nitrate within the SRB was calculated by measuring the total flow between times of water concentration measurements and multiplying this number by the difference between the concentration in the tile minus the average nitrate concentration in the monitoring wells nearest the stream. Summing over each calendar year measured nitrate loads from the tile ranged from 9.2 to 18.0 lbs/ac draining to this tile outlet while nitrate removed within the SRB ranged from 2.6 to 6.0 lbs/ac. This is equivalent to a 29% removal rate when averaged over 2016 – 2018. Summed over the three years, this SRB removed at least 564 lbs of nitrate-N. This is nitrate that would have otherwise entered the

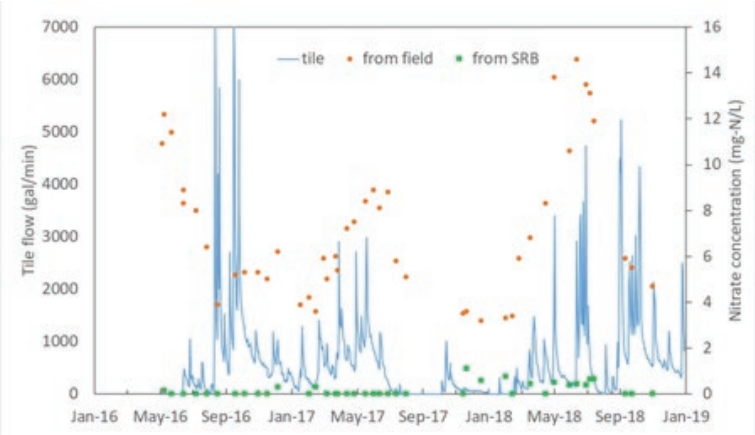

Figure 1. Water flow rate out of the field tile, nitrate concentrations in the tile water, and average nitrate concentrations in the observation wells closest to the stream.

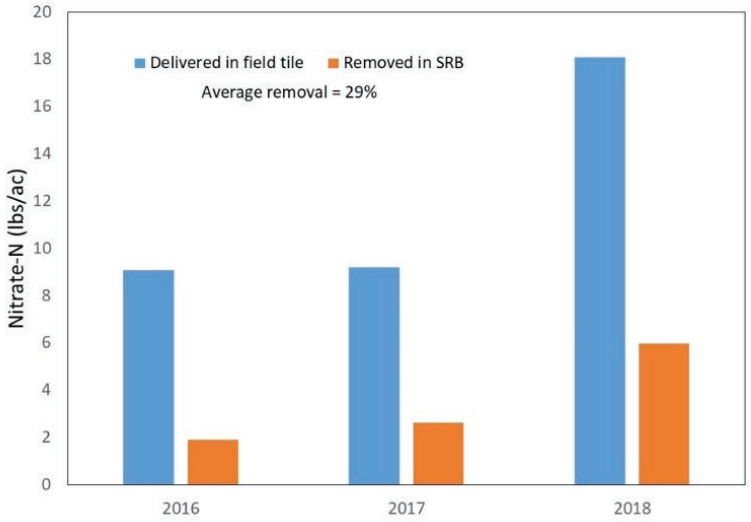

Figure 2: Total annual mass of nitrate leaving the field in the field tile at the control box and removed within the SRB for 2016-2018.

PUBLISHED WORKS FROM THE SITE

Jaynes, D.B., and T.M. Isenhart. 2019. Performance of saturated riparian buffers in Iowa, USA. Journal of Environmental Quality 48:289-296.

Data Access

Data from this site are available through the USDA National Ag Library Ag Data Commons repository (https://doi.org/10.15482/USDA.ADC/1521092) or the interactive website at Iowa State University with visualization and querying capabilities (https://drainagedata.org).

ACKNOWLEDGEMENTS

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