In-situ treatment of agricultural drainage water using industrial by-products phosphorus sorbing materials

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Agricultural drainage ditches are commonplace in the low-lying coastal plain landscapes of the United States. On Maryland's eastern shore there are approximately 1321 km of publicly managed drainage ditches that drain 74060 hectares of land. Agriculture is one of the major land uses within this region and is dominated by intensive poultry production. Nutrient imbalances that have existed for decades have resulted in soils saturated with phosphorous (P). As a result, drainage ditches represent a direct pathway for high nutrient loads to be transported from fields to surface waters. In one study Kleinman et al. (2007) found that nutrient loads can range from 1.4 to 26.2 kg-P ha^{-1} $year^{-1}$ from drainage ditches. Furthermore, they found that greater than 90% of the nutrients transported by drainage ditches enter the ditches through subsurface pathways. However, most practices used to reduce P loading from agricultural fields target overland flow and therefore would have little impact in these landscapes. These ditches also represent a possible intervention point in the system at which P derived from runoff and sub-surface flow generated across large acreages of agricultural soils can be prevented from entering the Chesapeake Bay at a single point. The objective of this study was to construct a filter structure using industrial waste by-products to directly remove P from runoff and subsurface drainage waters entering ditches on Maryland's eastern shore. Design of filter structure, P removal effectiveness of by-product in filter structure, and overall impact on water quality will be discussed. Field prototypes of the proposed system have shown a high likelihood of success, removing approximately 60 – 90% of the P from treated water. In addition to removing P from ditch water these treatment systems have the potential to remove nitrogen, sediment, and other contaminants.

Kleinman, P.J.A., A.L. Allen, B.A. Needelman, A.N. Sharpley, P.A. Vadas, L.S. Saporito, G.J. Folmar, and R.B. Bryant. 2007. Dynamics of phosphorus transfers from heavily manured Coastal Plain soils to drainage ditches. J. Soil Water Conserv. 62: 225- 235.